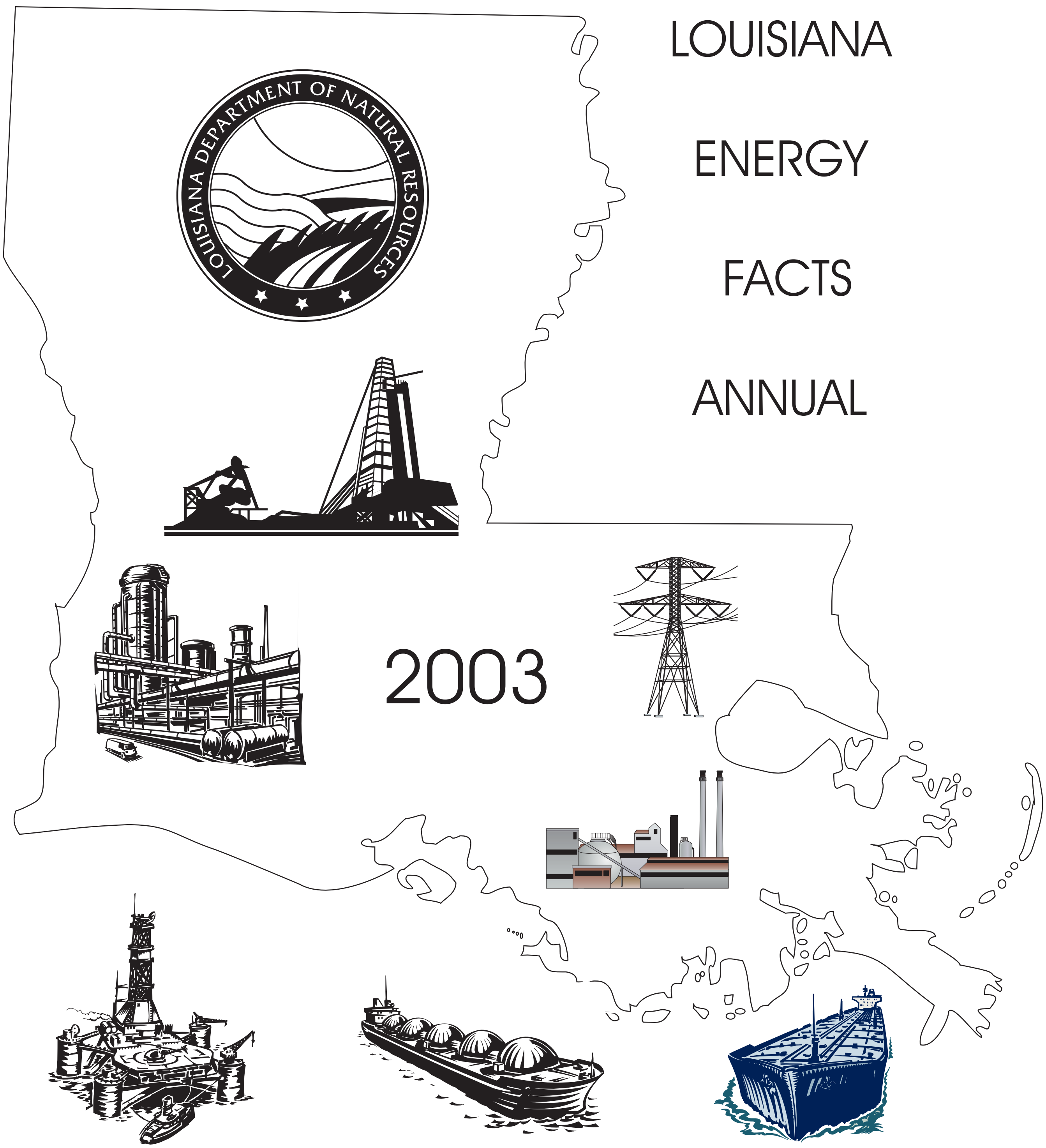
LOUISIANA ENERGY FACTS ANNUAL

2003



DEPARTMENT OF NATURAL RESOURCES
Technology Assessment Division
January 14, 2004

APPENDICES

The Sol of New Orleans II
The University of New Orleans's solar powered car

Appendix A

Abbreviations

BCF	Billion Cubic Feet
BTU	British Thermal Unit
DNR	Louisiana Department of Natural Resources
DOE	United States Department of Energy
DOI	United States Department of the Interior
EIA	Energy Information Administration, DOE
FOB	Free on Board
KWH	Kilowatt-hours
MBBLS	Thousand Barrels
MCF	Thousand Cubic Feet
MMS	Minerals Management Service, DOI
MST	Thousand Short Tons
NGC	Natural Gas Clearinghouse
OCS	Outer Continental Shelf
OPEC	Organization of Petroleum Exporting Countries
RAC	Refinery Acquisition Costs
SLS	South Louisiana Sweet Crude Oil
SPR	Strategic Petroleum Reserve
TBTU	Trillion BTU
TCF	Trillion Cubic Feet

State Abbreviations Used in the Louisiana Energy Facts Annual

AL	Alabama	MS	Mississippi
AK	Alaska	ND	North Dakota
CA	California	NM	New Mexico
CO	Colorado	OK	Oklahoma
IL	Illinois	TX	Texas
KS	Kansas	UT	Utah
LA	Louisiana	WY	Wyoming
MI	Michigan		

Appendix B

Data Sources

Unless otherwise specified, data is from the Louisiana Department of Natural Resources.

1. EMPLOYMENT AND TOTAL WAGES PAID BY EMPLOYERS SUBJECT TO LOUISIANA EMPLOYMENT SECURITY LAW, Baton Rouge, LA: Louisiana Department of Labor, Office of Employment Security, Research and Statistics Unit.

2. MONTHLY ENERGY REVIEW and ANNUAL ENERGY REVIEW, Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

3. NATURAL GAS MONTHLY and NATURAL GAS ANNUAL, Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

4. Baker Hughes from OIL & GAS JOURNAL, Tulsa, OK: Penn Well Publishing Co.

5. October 2002 to Present, NATURAL GAS WEEK, Washington, D.C.: Energy Intelligence Group. Prior, SURVEY OF DOMESTIC SPOT MARKET PRICES, Houston, TX: Dynegy Inc. (Formerly Natural Gas Clearinghouse).

6. PETROLEUM MARKETING MONTHLY and PETROLEUM MARKETING ANNUAL, Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

7. PETROLEUM SUPPLY MONTHLY and PETROLEUM SUPPLY ANNUAL, Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

8. SEVERANCE TAX, Baton Rouge, LA: Louisiana Department of Revenue and Taxation, Severance Tax Section.

9. U.S. CRUDE OIL, NATURAL GAS and NATURAL GAS LIQUIDS RESERVES, Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

10. THE WALL STREET JOURNAL, Gulf Coast Edition, Beaumont, TX: Dow Jones and Company.

11. STATE ENERGY DATA REPORT, Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

12. FEDERAL OFFSHORE STATISTICS, Washington, D.C.: U.S. Department of the Interior, Minerals Management Service.

13. MINERAL REVENUE, Washington, D.C.: U.S. Department of the Interior, Minerals Management Service, Royalty Management Program.

14. ELECTRIC POWER MONTHLY, Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

Appendix C

Glossary

Bonus. A cash payment by the lessee for the execution of a lease. A lease is a contract that gives a lessee the right: (a) to search for minerals, (b) to develop the surface for extraction, and (c) to produce minerals within the area covered by the contract.

Casinghead Gas. All natural gas released from oil during the production of oil from underground reservoirs.

City-Gate. A point or measuring station at which a gas distribution company receives gas from a pipeline company or transmission system.

Commercial Consumption. Gas used by non-manufacturing organizations such as hotels, restaurants, retail stores, laundries, and other service enterprises. This also includes gas used by local, state, and federal agencies engaged in non-manufacturing activities.

Condensate. (See Lease Condensate).

Crude Oil. A mixture of hydrocarbons that existed in the liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities.

CRUDE OIL PRICES

Domestic Wellhead. The average price at which all domestic crude oil is first purchased.

Imports FOB. The price actually charged at the producing country's port of loading. It is the responsibility of the buyer to arrange for transportation and insurance.

Imports Landed. The dollar per barrel price of crude oil at the port of discharge. It includes crude oil landed in the U.S. and U.S. company-owned refineries in the Caribbean, but excludes crude oil from countries that export only small amounts to the United States. The landed price does not include charges incurred at the port of discharge.

Imports OPEC FOB. The average price actually charged by OPEC at their country's port of loading. This price does not include transportation or insurance.

OCS Gulf. The average price at which all offshore, Outer Continental Shelf, Central Gulf region crude oil is first purchased as reported by the U.S. Department of Energy, Energy Information Administration.

Refinery Acquisition Costs (RAC). The average price paid by refiners in the U.S. for crude oil booked into their refineries in accordance with accounting procedures generally accepted and consistently and historically applied by the refiners.

a) **Domestic**. The average price of crude oil produced in the United States or from the Outer Continental Shelf of the U.S.

b**) Imports**. The average price of any crude oil not reported as domestic.

Refinery Posted. The average price from a survey of selected refiners' postings for South Louisiana Sweet (SLS) crude, which is effective at the middle and at the end of the month.

Severance Tax. The average wellhead price calculated from oil severance taxes paid to the Louisiana Department of Revenue and Taxation.

Spot Market. The spot market crude oil price is the average of daily South Louisiana Sweet (SLS) crude price futures traded in the month and usually includes transportation from the producing field to the St. James, Louisiana terminal.

State. The average price at which all Louisiana crude oil, excluding Louisiana OCS, is first purchased as reported in a survey by the U.S. Department of Energy, Energy Information Administration.

State Royalty. The average wellhead price from its royalty share of oil produced in state lands or water bottoms. The price is calculated by the ratio of received oil royalty gross revenue divided by royalty volume share reported to the Louisiana Department of Natural Resources.

Developmental Well. Wells drilled within the proved area of an oil or gas reservoir to the depth of a stratigraphic horizon known to be productive.

Dry Gas. (See Natural Gas, "Dry").

Dry Hole. An exploratory or developmental well found to be incapable of producing either oil or gas in sufficient quantities to justify completion as an oil or gas well.

Electric Utility Consumption. Gas used as fuel in electric utility plants.

Exploratory Well. A well drilled to find and produce oil or gas in an unproved area, to find a new reservoir in an old field, or to extend the limits of a known oil or gas reservoir.

Exports. Crude oil or natural gas delivered out of the Continental United States and Alaska to foreign countries.

Extraction Loss. The reduction in volume of natural gas resulting from the removal of natural gas liquid constituents at natural gas processing plants.

Federal Offshore or Federal OCS. (See Louisiana OCS)

FOB Price (Free on board). The price actually charged at the producing country's port of loading. The reported price includes deductions for any rebates and discounts or additions of premiums where applicable and should be the actual price paid with no adjustment for credit terms.

Gate. (See City-Gate)

Gross Revenue. Amount of money received from a purchaser, including charges for field gathering, transportation from wellhead to purchaser receiving terminal, and state production severance tax.

Gross Withdrawals. (See Natural Gas, Gross Withdrawals)

Imports. Crude oil or natural gas received in the Continental United States, Alaska, and Hawaii from foreign countries.

Industrial Consumption. Natural gas used by manufacturing and mining establishments for heat, power, and chemical feedstock.

Lease Condensate. A mixture consisting primarily of pentane and heavier hydrocarbons that is recovered as a liquid from natural gas in lease or field separation facilities, exclusive of products recovered at natural gas processing plants or facilities.

Lease Separator. A facility installed at the surface for the purpose of: (a) separating gases from produced crude oil and water at the temperature and pressure conditions of the separator, and/or (b) separating gases from that portion of the produced natural gas stream which liquefies at the temperature and pressure conditions of the separator.

Louisiana OCS. Submerged lands under federal regulatory jurisdiction that comprise the Continental Margin or Outer Continental Shelf adjacent to Louisiana and seaward of the Louisiana Offshore region.

Louisiana Offshore. A 3-mile strip of submerged lands under state regulatory jurisdiction located between the State coast line and the OCS region.

Louisiana Onshore. Region defined by the State boundary and the coast line.

Major Pipeline Company. A company whose combined sales for resale, and gas transported interstate or stored for a fee, exceeded 50 million thousand cubic feet in the previous year.

Marketed Production. (See Natural Gas, Marketed Production)

Natural Gas. A mixture of hydrocarbon compounds and small quantities of various non-hydrocarbons existing in the gaseous phase or in solution with crude oil in natural underground reservoirs at reservoir conditions. The principal hydrocarbons usually contained in the mixture are methane, ethane, propane, butanes and pentanes. Typical non-hydrocarbon gases that may be present in reservoir natural gas are carbon dioxide, helium, hydrogen sulfide and nitrogen. Under reservoir conditions, natural gas and the liquefiable portions occur either in a single gaseous phase in the reservoir or in solution with crude oil, and are not distinguishable at the time as separated substances.

Natural Gas, "Dry". The actual or calculated volume of natural gas which remains after: (a) the liquefiable hydrocarbon portion has been removed from the gas stream, and (b) any volumes of non-hydrocarbon gases have been removed where they occur in sufficient quantity to render the gas unmarketable.

Natural Gas, Gross Withdrawals. Full well-stream volume, including all natural gas plant liquids and all non-hydrocarbon gases, but excluding lease condensate.

Natural Gas Liquids. Lease condensate plus natural gas plant liquids.

Natural Gas, Marketed Production. Gross withdrawals less gas used for repressurizing, quantities vented and flared, and non-hydrocarbon gases removed in treating or processing operations. It includes all quantities of gas used in field and processing operations.

Natural Gas, OCS Gas. OCS gas volume is as reported. Most is "dry" gas, though some is "wet" gas.

Natural Gas Plant Liquids. Those hydrocarbons remaining in a natural gas stream after field separation and later separated and recovered at a natural gas processing plant or cycling plant through the processes of absorption, adsorption, condensation, fractionation or other methods. Generally such liquids consist of propane and heavier hydrocarbons and are commonly referred to as condensate, natural gasoline, or liquefied petroleum gases. Where hydrocarbon components lighter than propane (e.g., ethane) are recovered as liquids, these components are included with natural gas liquids.

NATURAL GAS PRICES

Henry Hub Settled NYMEX The last trading day price for the month before delivery posted in the New York Mercantile Exchange for natural gas at Henry Hub.

Spot Market The average price of natural gas paid at the regional spot market receipt points or zones as reported by the Energy Intelligence Group's NATURAL GAS WEEK. The data are a volume weighted average and reflect market activity information gathered during the entire month before the publication date, regardless of delivery date. The data are not an arbitrary weighting by production zone, but a true deal-by-deal volume weighting of prices gathered. Data prior to October 2002 were from Dynegy's survey of the domestic natural gas spot market receipt points or zones located in Louisiana. The new and old points or zones are as follows:

NATURAL GAS PIPELINES AND SALES POINTS FOR PRICES

Dynegy	**Natural Gas Week**
ANR	ANR
Eunice, LA	Patterson, LA
COLUMBIA GULF	COLUMBIA GULF TRANSMISSION Co.
Average Louisiana onshore laterals	Average of Erath, Rayne, and Texaco Henry Plant in Louisiana
LOUISIANA INTRASTATES	LOUISIANA INTRASTATES
Average of Faustina, LIG, Bridgeline, and Monterrey pipelines	Average of LIG, Bridgeline, LRC, and Acadian pipelines
SOUTHERN NATURAL	SOUTHERN NATURAL
South Louisiana	Saint Mary Parish, LA
TENNESSEE GAS	TENNESSEE GAS
Vinton, LA	South Louisiana
TEXAS GAS TRANSMISSION	TEXAS GAS TRANSMISSION
Zone 1 (North Louisiana)	Zone 1 (North Louisiana)
GULF SOUTH PIPELINE	TRUNKLINE GAS Co.

OCS. The average wellhead price calculated from sales and volumes from Louisiana OCS natural gas as reported by the U.S. Department of Interior, Minerals Management Service.

State Royalty. The average wellhead price calculated from revenue received and volumes reported to the Louisiana Department of Natural Resources.

State Wells. The average price of gas sold at Louisiana wellhead. This price includes: (a) value of natural gas plant liquids subsequently removed from the gas, (b) gathering and compression charges, and (c) State production, severance, and/or similar charges.

Major Pipelines Purchases.

a) **Domestic Producers**. The average price of natural gas produced in the United States or from the Outer Continental Shelf of the U.S.

b**) Foreign Imports**. The average price of any natural gas not reported as domestic.

Wellhead. The wellhead sales price including: (a) value of natural gas plant liquids subsequently removed from the gas, (b) gathering and compression charges, and (c) State production, severance, and/or similar charges.

Natural Gas, Wet After Lease Separation. The volume of natural gas, if any, remaining after: (a) removal of lease condensate in lease and/or field separation facilities, and (b) exclusion of non-hydrocarbon gases where they occur in sufficient quantities to render the gas unmarketable. Also excludes gas returned to formation in pressure maintenance and secondary recovery projects and gas returned to earth from cycling and/or gasoline plants. Natural gas liquids may be recovered from volumes of natural gas, wet after lease separation, at natural gas processing plants.

Organization of Petroleum Exporting Countries (OPEC). Countries that have organized for the purpose of negotiating with oil companies on matters of oil production, prices, and future concession rights. Current members are Algeria, Gabon, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela.

Outer Continental Shelf (OCS). All submerged lands that comprise the Continental Margin adjacent to the U.S. and seaward of the state offshore lands. Production in the OCS is under federal regulatory jurisdiction and ownership.

Processing Plant. A facility designed to recover natural gas liquids from a stream of natural gas which may or may not have passed through lease separators and/or field separation facilities. Another function of natural gas processing plants is to control the quality of the processed natural gas stream.

Proved Reserves of Crude Oil. As of December 31 of the report year, the estimated quantities of all liquids defined as crude oil which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. Volumes of crude oil in underground storage are not considered proved reserves.

Proved Reserves of Lease Condensate. The volumes of lease condensate as of December 31 of the report year expected to be recovered in future years in conjunction with the production of proved reserves of natural gas as of December 31 of the report year.

Proved Reserves of Natural Gas. The estimated quantities of natural gas as of December 31 of the report year which analysis of geologic and engineering data demonstrates with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. Volumes of natural gas in underground storage are not considered proved reserves.

Proved Reserves of Natural Gas Liquids. The volumes of natural gas liquids (including lease condensate) as of December 31 of the report year, which analysis of geologic and engineering data demonstrates with reasonable certainty to be separable in the future from proved natural gas reserves under existing economic and operating conditions.

Rental. Money paid by the lessee to maintain the lease after the first year if it is not producing. A lease is considered expired when rental is not paid on time on an unproductive lease.

Reservoir. A porous and permeable underground formation containing an individual and separate natural accumulation of producible hydrocarbons (oil and/or gas) which is confined by impermeable rock or water barriers and is characterized by a single natural pressure system. Reservoirs are considered proved if economic producibility is supported by actual production or conclusive formation tests (drill stem or wire line), or if economic producibility is supported by core analysis and/or electric or other log interpretations. The area of a gas or oil reservoir considered proved includes: (a) that portion delineated by drilling and defined by gas-oil and/or gas-water contacts, if any; and (b) the immediately adjoining portions not yet drilled, but which can be reasonably judged as economically productive on the basis of available geological and engineering data.

Residential Consumption. Gas used in private dwellings, including apartments, for heating, cooking, water heating, and other household uses.

Royalty (Including Royalty Override) Interest. Those interests which entitle their owner(s) to a share of the mineral production from a property or to a share of the proceeds from there. These interests do not contain the rights and obligations of operating the property and normally do not bear any of the costs of exploration, development, or operation of the property.

Royalty Override (Or Overriding Royalty). An interest in oil and gas produced at the surface free of any cost of production. It is royalty in addition to the usual landowner's royalty reserved to the lessor. The Layman's Guide to Oil & Gas by Brown & Miller defines overriding royalty as a percentage of all revenue earned by a well and carrying no cost obligation.

State Offshore. (See Louisiana Offshore**).**

Wet After Lease Separation. (See Natural Gas, Wet After Lease Separation).

Wildcat Well . (See Developmental Well).

Appendix D

Louisiana Gas Volume at 14.73 psia

<u>Page</u>

Appendix D-1

LOUISIANA STATE GAS PRODUCTION, WET AFTER LEASE SEPARATION

Natural Gas and Casinghead Gas, Excluding OCS

(Thousand Cubic Feet (MCF) at 14.73 psia and 60 degrees Fahrenheit)*

DATE	NORTH		SOUTH		OFFSHORE		TOTAL	
1982	381,956,386	r	1,548,825,526	r	362,541,475	r	2,293,323,387	r
1983	367,415,635	r	1,330,669,947	r	323,523,633	r	2,021,609,215	r
1984	389,939,125	r	1,400,621,534	r	320,286,543	r	2,110,847,202	r
1985	358,032,963	r	1,274,608,554	r	255,072,018	r	1,887,713,536	r
1986	370,901,958	r	1,240,893,984	r	251,033,103	r	1,862,829,044	r
1987	363,802,599	r	1,175,490,485	r	232,692,536	r	1,771,985,620	r
1988	382,100,449	r	1,192,889,101	r	218,544,278	r	1,793,533,828	r
1989	386,783,455	r	1,153,294,096	r	207,381,469	r	1,747,459,020	r
1990	398,236,494	r	1,160,425,829	r	185,678,416	r	1,744,340,739	r
1991	389,623,599	r	1,139,243,110	r	152,895,972	r	1,681,762,681	r
1992	379,671,005	r	1,146,893,542	r	149,933,256	r	1,676,497,803	r
1993	360,897,088	r	1,126,950,007	r	156,919,403	r	1,644,766,497	r
1994	361,146,486	r	1,048,229,785	r	158,315,609	r	1,567,691,880	r
1995	370,709,558	r	1,028,500,599	r	167,742,330	r	1,566,952,486	r
1996	425,506,052	r	1,048,009,685	r	189,331,696	r	1,662,847,432	r
1997	450,873,442	r	995,341,920	r	189,565,415	r	1,635,780,777	r
1998	446,138,374	r	979,584,537	r	183,246,642	r	1,608,969,552	r
1999	402,085,989	r	928,879,872	r	152,594,840	r	1,483,560,702	r
2000	395,857,269	r	945,959,335	r	152,498,651	r	1,494,315,254	r
2001	398,313,842	r	973,016,534	r	153,871,183	r	1,525,201,559	r
January	31,148,432	r	76,396,199	r	11,915,659	r	119,460,291	r
February	28,529,608	r	70,126,591	r	10,906,488	r	109,562,688	r
March	31,467,444	r	77,537,049	r	12,031,321	r	121,035,814	r
April	30,039,244	r	74,206,791	r	11,489,019	r	115,735,053	r
May	31,474,373	r	77,957,824	r	12,043,227	r	121,475,424	r
June	30,697,455	r	76,232,301	r	11,745,180	r	118,674,936	r
July	31,173,347	r	77,608,087	r	11,922,711	r	120,704,145	r
August	31,279,970		78,082,946		11,967,576		121,330,492	
September	28,704,031		71,837,625		10,975,965		111,517,622	
October	26,689,214		66,972,484		10,201,238		103,862,936	
November	28,571,808		71,922,722		10,950,866		111,445,396	
December	29,647,603		73,407,136		11,043,781		114,098,519	
2002 Total	**359,422,530**		**892,287,755**		**137,193,030**		**1,388,903,315**	
January	29,796,689		74,166,333		11,175,552		115,138,574	
February	27,402,429		68,378,596		10,286,316		106,067,341	
March	30,847,275		77,194,060		11,589,724		119,631,059	
April	29,933,649		75,104,135		11,258,599		116,296,383	
May	30,012,935		76,188,336		11,407,138		117,608,409	
June	28,703,144		73,051,724		10,925,152		112,680,020	
July	29,078,676		74,201,190		11,080,744		114,360,610	
August	27,967,078		71,465,755		10,667,877		110,100,710	
September	27,791,077		71,202,127		10,613,713		109,606,916	
October	27,615,466		70,938,803		10,559,951		109,114,220	
November	27,439,828	e	70,675,483	e	10,506,155	e	108,621,466	e
December	27,263,537	e	70,411,642	e	10,451,692	e	108,126,871	e
2003 Total	**343,851,783**	**e**	**872,978,184**	**e**	**130,522,613**	**e**	**1,347,352,579**	**e**

e Estimated r Revised p Preliminary

* See Table 11 corresponding volumes at 15.025 psia and footnote in Appendix B.

Appendix D-2

LOUISIANA STATE GAS PRODUCTION, WET AFTER LEASE SEPARATION

Natural Gas and Casinghead Gas

(Thousand Cubic Feet (MCF) at 14.73 psia and 60 degrees Fahrenheit)*

DATE	ONSHORE	OFFSHORE State	OFFSHORE Federal OCS[12]	TOTAL
1982	1,930,781,912 r	362,541,475 r	4,106,494,590	6,399,817,977 r
1983	1,698,085,582 r	323,523,633 r	3,803,740,050	5,825,349,265 r
1984	1,790,560,659 r	320,286,543 r	3,173,892,354	5,284,739,556 r
1985	1,632,641,518 r	255,072,018 r	3,578,740,570	5,466,454,106 r
1986	1,611,795,941 r	251,033,103 r	3,116,884,490	4,979,713,534 r
1987	1,539,293,084 r	232,692,536 r	2,927,832,264	4,699,817,884 r
1988	1,574,989,550 r	218,544,278 r	3,180,107,195	4,973,641,023 r
1989	1,540,077,551 r	207,381,469 r	3,096,881,628	4,844,340,648 r
1990	1,558,662,324 r	185,678,416 r	3,006,576,061	4,750,916,800 r
1991	1,528,866,709 r	152,895,972 r	3,706,324,044	5,388,086,725 r
1992	1,526,564,547 r	149,933,256 r	3,289,968,602	4,966,466,405 r
1993	1,487,847,094 r	156,919,403 r	3,338,101,447	4,982,867,944 r
1994	1,409,376,270 r	158,315,609 r	3,386,808,653	4,954,500,533 r
1995	1,399,210,157 r	167,742,330 r	3,492,406,762	5,059,359,248 r
1996	1,473,515,737 r	189,331,696 r	3,636,067,997	5,298,915,429 r
1997	1,446,215,363 r	189,565,415 r	3,898,234,094	5,534,014,871 r
1998	1,425,722,911 r	183,246,642 r	3,913,885,048	5,522,854,600 r
1999	1,330,965,862 r	152,594,840 r	3,789,387,595	5,272,948,297 r
2000	1,341,816,603 r	152,498,651 r	3,987,022,817	5,481,338,071 r
2001	1,371,330,376 r	153,871,183 r	3,663,809,133	5,189,010,692 r
January	107,544,631 r	11,915,659 r	272,670,577 p	392,130,867 p r
February	98,656,199 r	10,906,488 r	242,827,946 p	352,390,634 p r
March	109,004,493 r	12,031,321 r	288,370,334 p	409,406,148 p r
April	104,246,035 r	11,489,019 r	282,684,272 p	398,419,326 p r
May	109,432,197 r	12,043,227 r	284,323,184 p	405,798,608 p r
June	106,929,756 r	11,745,180 r	301,970,600 p	420,645,536 p r
July	108,781,434 r	11,922,711 r	307,562,377 p	428,266,522 p r
August	109,362,916	11,967,576	321,909,161 p	443,239,653 p
September	100,541,657	10,975,965	252,902,541 p	364,420,162 p
October	93,661,698	10,201,238	247,305,339 p	351,168,275 p
November	100,494,529	10,950,866	312,927,361 p	424,372,757 p
December	103,054,738	11,043,781	299,447,413 p	413,545,932 p
2002 Total	**1,251,710,285**	**137,193,030**	**3,414,901,105 p**	**4,803,804,420 p**
January	103,963,022	11,175,552	290,000,000 e	405,138,574 e
February	95,781,025	10,286,316	251,000,000 e	357,067,341 e
March	108,041,335	11,589,724	289,357,805 e	408,988,865 e
April	105,037,784	11,258,599	282,220,236 e	398,516,618 e
May	106,201,270	11,407,138	288,033,980 e	405,642,389 e
June	101,754,868	10,925,152	272,742,997 e	385,423,017 e
July	103,279,866	11,080,744		114,360,610
August	99,432,833	10,667,877		110,100,710
September	98,993,203	10,613,713		109,606,916
October	98,554,269	10,559,951		109,114,220
November	98,115,311 e	10,506,155 e		108,621,466 e
December	97,675,179 e	10,451,692 e		108,126,871 e
2003 Total	**1,216,829,967 e**	**130,522,613 e**	**1,673,355,018**	**3,020,707,597 e**

e Estimated r Revised p Preliminary

* See Table 12 corresponding volumes at 15.025 psia and footnote in Appendix B.

NOTE: The 2003 Federal OCS production is estimated from the marketed production

Appendix D-3

LOUISIANA MARKETED AND DRY GAS PRODUCTION
(Billion Cubic Feet (BCF) at 14.73 psia and 60 degrees Fahrenheit)*

	MARKETED			EXTRACTION	
DATE	State	OCS	Total[3]	LOSS[3]	DRY[3]
1960	2,695 e	270 [12]	2,966 e	N/A	N/A
1961	2,785 e	315 [12]	3,100 e	N/A	N/A
1962	3,055 e	447 [12]	3,502 e	N/A	N/A
1963	3,317 e	559 [12]	3,876 e	N/A	N/A
1964	3,520 e	616 [12]	4,136 e	N/A	N/A
1965	3,731 e	639 [12]	4,370 e	N/A	N/A
1966	4,145 e	956 [12]	5,101 e	N/A	N/A
1967	4,640	1,076 [12]	5,717	115	5,602
1968	5,017	1,399 [12]	6,416	140	6,276
1969	5,424	1,804 [12]	7,228	179	7,049
1970	5,538	2,250 [12]	7,788	193	7,595
1971	5,474	2,608 [12]	8,082	195	7,887
1972	5,120	2,853 [12]	7,973	198	7,775
1973	5,217	3,025 [12]	8,242	207	8,036
1974	4,438	3,316 [12]	7,754	194	7,559
1975	3,792	3,299 [12]	7,091	190	6,901
1976	3,542	3,465 [12]	7,007	173	6,834
1977	3,604	3,611 [12]	7,215	166	7,049
1978	3,368	4,108 [12]	7,476	162	7,315
1979	3,149	4,117 [12]	7,266	166	7,101
1980	2,966	3,974 [12]	6,940	142	6,798
1981	2,715	4,065 [12]	6,780	142	6,638
1982	2,406	3,766 [12]	6,172	129	6,043
1983	2,190	3,142 [12]	5,332	124	5,208
1984	2,282	3,543 [12]	5,825	133	5,693
1985	1,928	3,086 [12]	5,014	118	4,896
1986	1,997	2,899 [12]	4,895	116	4,780
1987	1,974	3,148 [12]	5,123	125	4,998
1988	2,114	3,066 [12]	5,180	120	5,060
1989	2,102	2,977 [12]	5,078	121	4,957
1990	1,573	3,669 [12]	5,242	119	5,123
1991	1,777	3,257 [12]	5,034	129	4,905
1992	1,649	3,265 [3]	4,914	133	4,782
1993	1,674	3,317 [3]	4,991	130	4,861
1994	1,691	3,479 [3]	5,170	129	5,041
1995	1,683	3,425 [3]	5,108	146	4,962
1996	1,628	3,662 [3]	5,290	140	5,150
1997	1,505 [3]	3,725 [3]	5,230	150	5,080
1998	1,552 [3]	3,725 [3]	5,277	145	5,133
1999	1,567 [3]	3,709 [3]	5,276	165	5,111
2000	1,455 [3]	3,638 [3]	5,093	165	4,928
2001	1,503 [3]	3,747 [3]	5,249	153	5,097
2002	1,538 p	3,811 p	5,349 p	175 p	5,174

e Estimated r Revised p Preliminary

* See Table 13 corresponding volumes at 15.025 psia and footnote in Appendix B.

Appendix D-4

UNITED STATES OCS GAS PRODUCTION[12]

Natural Gas and Casinghead Gas

(Thousand Cubic Feet (MCF) at 14.73 psia and 60 degrees Fahrenheit)*

YEAR	LOUISIANA	TEXAS	CALIFORNIA	TOTAL
PRIOR	157,485,180	0	0	157,485,180
1956	82,892,538	0	0	82,892,538
1957	82,568,807	4,797	0	82,573,604
1958	127,692,848	0	0	127,692,848
1959	207,156,296	0	0	207,156,296
1960	273,034,451	0	0	273,034,451
1961	318,280,095	0	0	318,280,095
1962	451,952,659	0	0	451,952,659
1963	564,352,606	0	0	564,352,606
1964	621,731,438	0	0	621,731,438
1965	645,589,469	0	0	645,589,469
1966	965,387,849	42,059,386	0	1,007,447,235
1967	1,087,262,804	99,952,946	0	1,187,215,750
1968	1,413,467,606	109,910,787	799,685	1,524,178,078
1969	1,822,544,142	127,096,982	4,845,851	1,954,486,975
1970	2,273,147,040	133,300,404	12,229,147	2,418,676,591
1971	2,634,014,031	127,357,908	15,671,479	2,777,043,418
1972	2,881,364,733	147,156,459	10,033,581	3,038,554,773
1973	3,055,628,236	148,673,637	7,286,549	3,211,588,422
1974	3,349,170,864	159,979,401	5,573,642	3,514,723,907
1975	3,332,169,057	122,572,764	3,951,633	3,458,693,454
1976	3,499,865,900	92,582,425	3,475,201	3,595,923,526
1977	3,647,513,674	86,943,285	3,289,963	3,737,746,922
1978	4,149,731,136	231,857,450	3,472,292	4,385,060,878
1979	4,158,521,710	511,590,607	2,866,822	4,672,979,139
1980	4,013,707,434	624,642,526	3,107,023	4,641,456,983
1981	4,106,494,590	730,275,831	12,766,307	4,849,536,728
1982	3,803,740,050	858,020,298	17,750,924	4,679,511,272
1983	3,173,892,354	850,817,211	16,024,292	4,040,733,857
1984	3,578,740,570	931,293,582	27,806,899	4,537,841,051
1985	3,116,884,490	834,926,523	49,164,213	4,000,975,226
1986	2,927,832,264	978,370,552	42,689,021	3,948,891,837
1987	3,180,107,195	1,204,488,337	40,986,158	4,425,581,690
1988	3,096,881,628	1,178,422,561	34,570,638	4,309,874,827
1989	3,006,576,061	1,165,112,953	28,574,912	4,200,263,926
1990	3,706,324,044	1,348,075,361	38,531,764	5,092,931,169
1991	3,289,968,602	1,184,936,494	40,626,577	4,515,531,673
1992	3,338,101,447	1,239,389,547	40,873,660	4,685,644,725
1993	3,386,808,653	1,027,937,755	42,082,090	4,533,389,731
1994	3,492,406,762	1,014,204,135	41,679,064	4,657,017,829
1995	3,636,067,997	908,520,050	36,425,501	4,692,270,825
1996	3,898,234,094	972,873,759	37,822,941	5,024,420,807
1997	3,913,885,048	965,334,787	40,722,084	5,076,996,337
1998	3,789,387,595	867,606,779	26,431,191	4,835,387,697
1999	3,987,022,817	814,124,878	37,261,450	4,992,363,948
2000	3,661,353,702 r	865,548,000 r	36,712,196 r	4,673,123,023 r
2001	3,959,435,998 p	601,937,028 p	41,266,568 p	4,712,026,562 p
2002	N/A	N/A	N/A	4,433,827,749 p

e Estimated r Revised p Preliminary

* See Table 15 corresponding volumes at 15.025 psia and footnote in Appendix B.

Appendix D-5

UNITED STATES NATURAL GAS AND CASINGHEAD GAS PRODUCTION[3]

(Billion Cubic Feet (BCF) at 14.73 psia and 60 degrees Fahrenheit)*

DATE	GROSS	WET AFTER LEASE SEPARATION	MARKETED	DRY	GROSS IMPORTS
1982	20,272	18,675	18,582	17,820	933
1983	18,659	16,979	16,884	16,094	918
1984	20,267	18,412	18,304	17,466	843
1985	19,607	17,365	17,270	16,454	950
1986	19,131	16,956	16,859	16,059	750
1987	20,140	17,557	17,433	16,621	993
1988	20,999	18,061	17,918	17,103	1,294
1989	21,074	18,237	18,095	17,311	1,382
1990	21,523	18,744	18,594	17,810	1,532
1991	21,750	18,702	18,532	17,698	1,773
1992	22,132	18,879	18,712	17,840	2,138
1993	22,725	19,209	18,982	18,095	2,350
1994	23,581	19,938	19,710	18,821	2,624
1995	23,743 r	19,790 r	19,506 r	18,598 r	2,841 r
1996	24,114 r	20,084 r	19,812 r	18,854 r	2,937 r
1997	24,213 r	20,122 r	19,865 r	18,902 r	2,994 r
1998	24,108 r	20,064 r	19,961 r	19,024 r	3,152 r
1999	23,823 r	19,915 r	19,805 r	18,832 r	3,586 r
2000	24,174 r	20,289 r	20,198 r	19,182 r	3,782 r
2001	24,476 r	20,716 r	20,630 r	19,676 r	3,977 r
January	2,066 r	1,706 r	1,698 r	1,620 r	343 r
February	1,857 r	1,523 r	1,517 r	1,447 r	305 r
March	2,077 r	1,711 r	1,704 r	1,625 r	332 r
April	1,985 r	1,641 r	1,634 r	1,558 r	317 r
May	2,063 r	1,713 r	1,706 r	1,628 r	316 r
June	2,002 r	1,670 r	1,663 r	1,586 r	317 r
July	2,040 r	1,728 r	1,720 r	1,641 r	344 r
August	2,039	1,709	1,702	1,624	355
September	1,901	1,593	1,586	1,513	335
October	1,985	1,636	1,629	1,554	343
November	2,010	1,692	1,685	1,608	330
December	2,104	1,731	1,724	1,644	369
2002 Total	**24,130**	**20,053**	**19,969**	**19,047**	**4,008**
January	2,103	1,745	1,738	1,658	345
February	1,922	1,582	1,576	1,503	297
March	2,131	1,774	1,767	1,685	312
April	2,021	1,685	1,678	1,601	294
May	2,066	1,735	1,728	1,648	305
June	1,997	1,670	1,664	1,587	283
July	2,032	1,700	1,694	1,616	344
August	N/A	N/A	N/A	N/A	336
September	N/A	N/A	N/A	N/A	N/A
October	N/A	N/A	N/A	N/A	N/A
November	N/A	N/A	N/A	N/A	N/A
December	N/A	N/A	N/A	N/A	N/A
2003 Total	**14,272**	**11,892**	**11,846**	**11,299**	**2,518**

e Estimated r Revised p Preliminary

* See Table 16 corresponding volumes at 15.025 psia and footnote in Appendix B.

Appendix E

Louisiana Energy Briefs and Topics

AMERICA'S WETLAND ENERGY CORRIDOR TO THE NATION

Parts 5-7 of this series will be published in the next report.

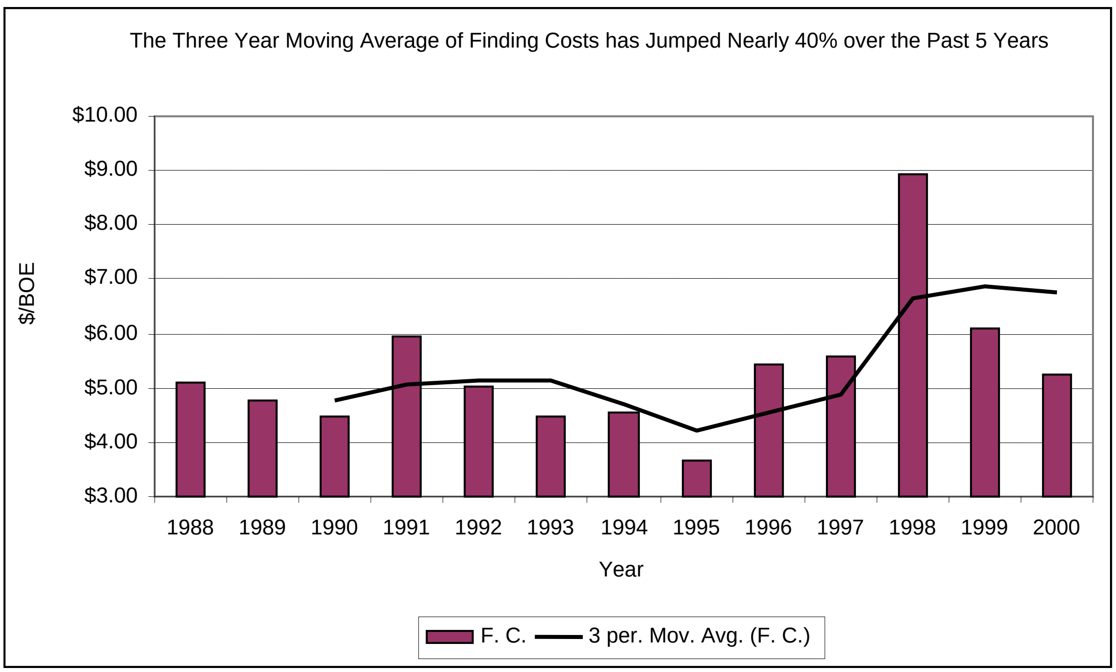
Calumet Refinery 1996

Originally Published in January 2003 Louisiana Energy Facts

FINDING COST INCREASE CHALLENGES E&P SECTOR

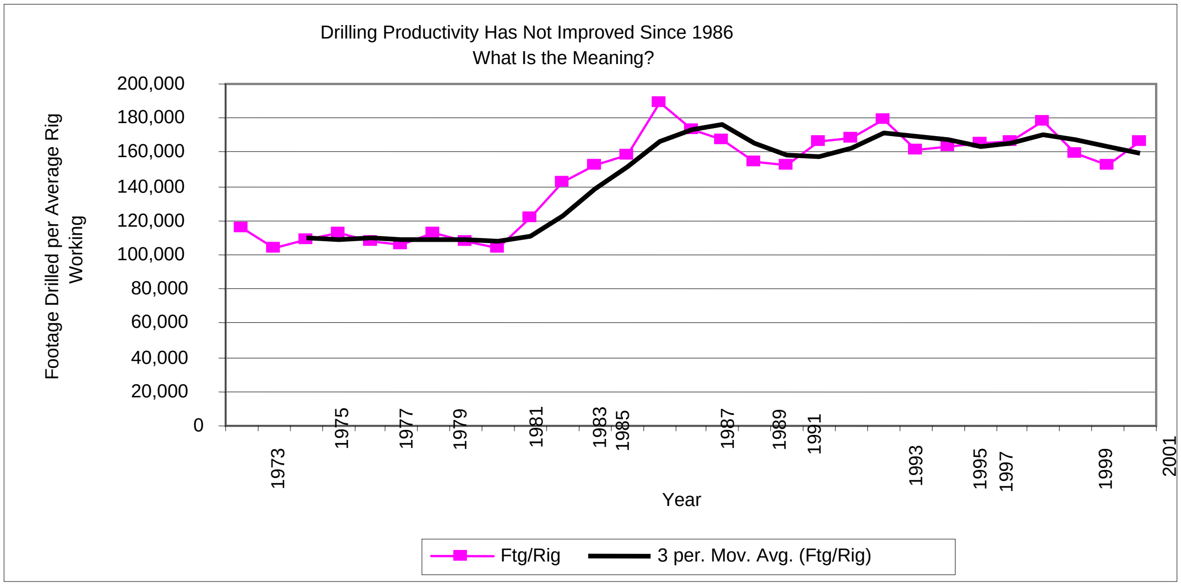
By Bob Sprehe, Energy Economist

For an exploration and production (E&P) company, finding costs are those costs associated with adding to the company's oil and gas reserves. These costs include surface costs and subsurface costs. The Energy Information Administration (EIA), through its Financial Reporting Service, keeps track of the cost elements associated with calculating an E&P company's finding costs. To calculate finding cost it is necessary to convert oil and natural gas reserves to a common unit, in this case Btus. Then the Btus can be converted back to a common denominator, barrels oil equivalent. The costs are accumulated and divided by BOE to arrive at an annual cost per BOE, expressed $/BOE. It is customary to average these costs over a 3 year period to eliminate annual volatility.

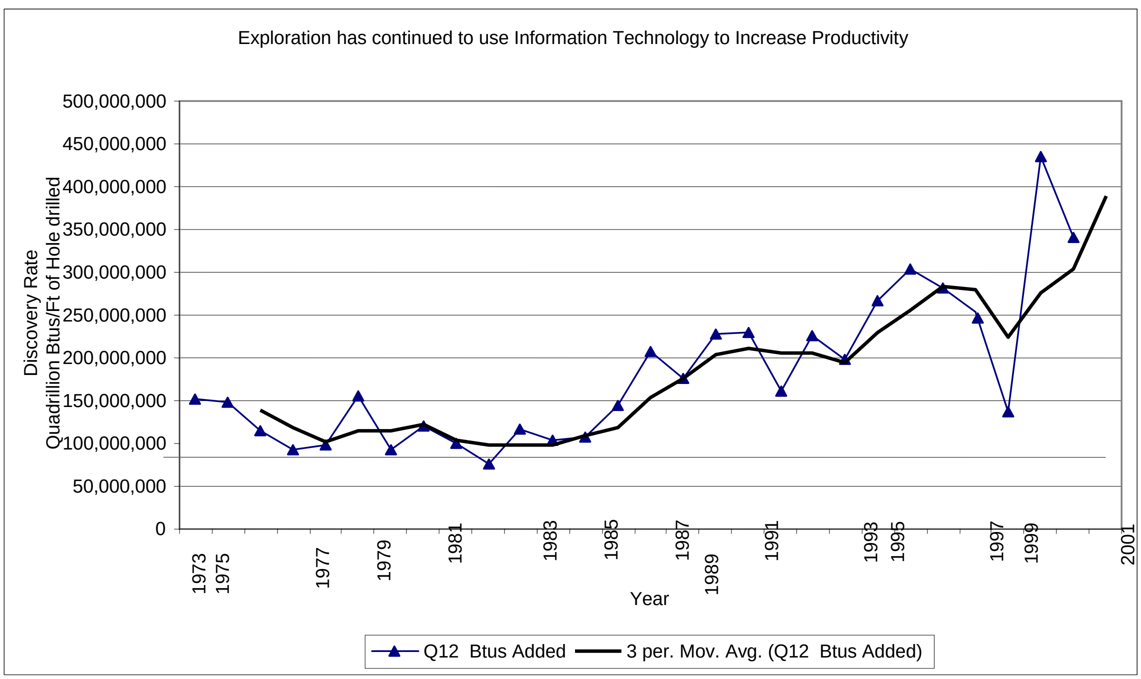


To analyze why costs have jumped in the recent past it is useful to examine two broader sets of productivity data: Physical Drilling Productivity and Knowledge Based Discovery Rate Productivity.

Despite sharing best practices, benchmarking, and the introduction of new technology, drilling productivity, as measured by footage drilled per rig per year, has remained relatively constant for the past 14 years (1987-2001).



Knowledge based geophysical and geological technology delivers a steady increase in industry productivity as measured by discovery rate per foot of hole drilled



While many factors go into the details of finding cost and why such costs might be rising, it should be noted that well drilling operations are conducted under highly prescriptive rules and regulations which add to costs; whereas seismic acquisition and reservoir characterization, and knowledge based activities are not. This may help explain why rig footage drilled productivity is flat while discovery rates are improving.

Originally Published in April 2003 Louisiana Energy Facts

Ethanol Industry Update

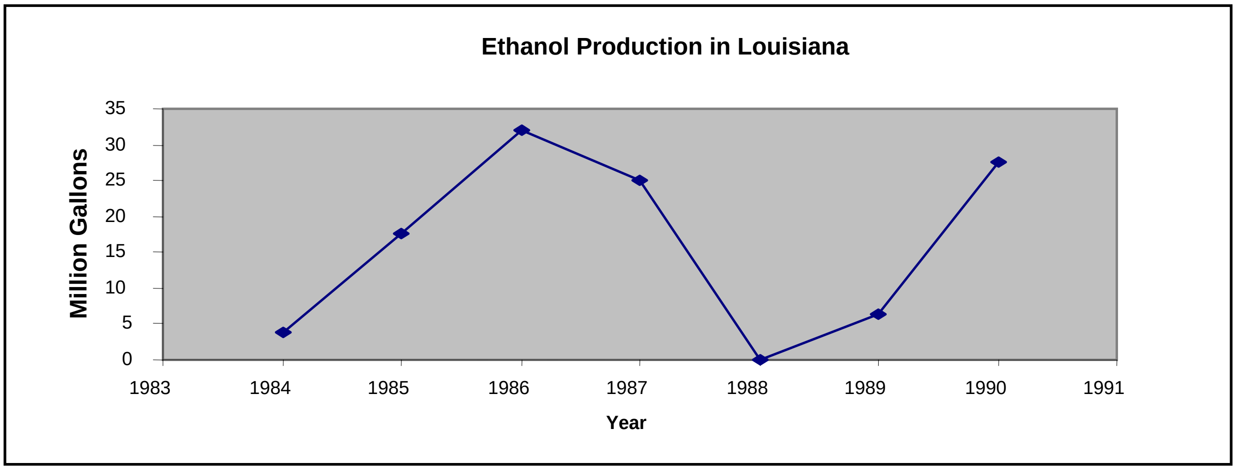
By Bryan Crouch, P.E.

At the state level, ethanol production has been dormant since 1990, but should soon be producing again. BC International's ethanol plant conversion in Jennings appears to be back on track after struggling to obtain financing for the project. State Agricultural Commissioner Bob Odom's plans for an ethanol plant in Lacassine have been shelved due to high cost estimates for construction, but local officials are still working to make it a reality.

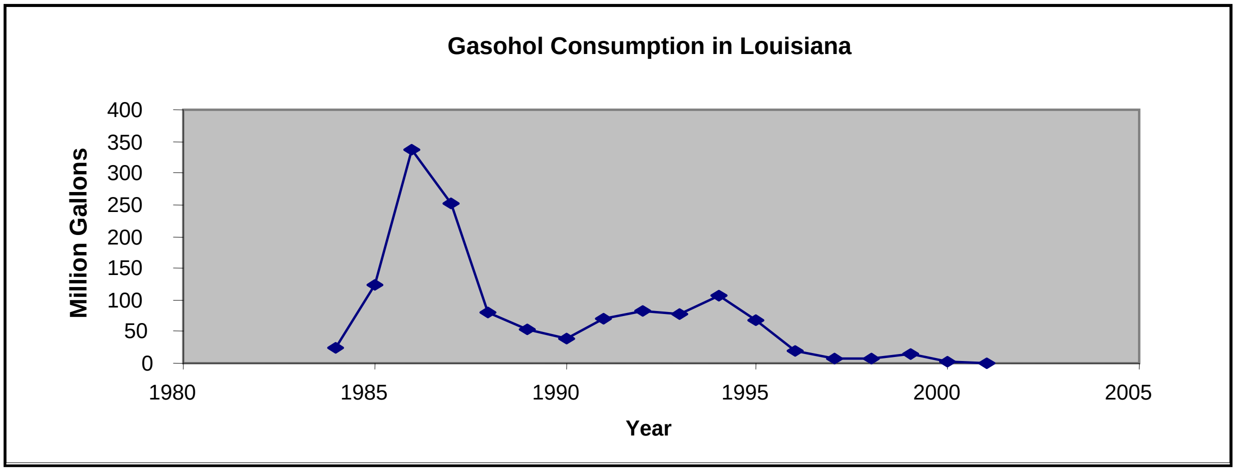
On the national level, the ethanol industry has received much attention lately. Much of the attention results from proposed federal energy legislation and states phasing out methyl tertiary-butyl ether (MTBE), which is widely used as an oxygenate and octane additive in gasoline. A federal energy bill is currently being debated in congress. One of the main goals is to heighten national energy security by reducing our dependence on foreign sources of energy. Another goal seeks to better the environment by reducing automobile pollution. A provision in the proposed federal energy bill aims at helping to meet both of these goals. The provision is a renewable fuel standard which would require a certain volume of the U.S. gasoline market to be composed of renewable fuels. A renewable fuel standard would more than double the current market for ethanol.

Louisiana

Ethanol was produced in Louisiana from 1984 to 1990 with a peak of 32 million gallons in 1986. When state subsidies ended in 1988, ethanol production was no longer economically feasible and the last plant ceased production in 1990.



Gasohol consumption also peaked in 1986 at 336 million gallons and has since declined to almost zero.



See the department's publication entitled *Ethanol in Louisiana 1993* for a more complete history of the ethanol industry in Louisiana. Contact the department for a copy[2]. There has been some renewed interest in ethanol in Louisiana and it may be produced in Louisiana again in the near future.

In 1994, the old Shepherd Oil refinery (converted to an ethanol plant) in Jennings, LA was purchased by Massachusetts firm BC International with plans to convert it into a 20 million gallon per year (MM GPY) biomass-to-ethanol facility. The plant would utilize mainly bagasse as a feedstock, although the process is able to use a wide variety of agricultural and paper or wood waste products. The patented BCI process uses a genetically engineered microorganism that breaks down complex sugars contained in biomass. These complex sugars cannot be broken down by fermentation. Fermentation is the process used in conventional ethanol plants that converts the simple sugars contained in sugar cane and starchy raw materials, such as corn, into ethanol. The ability to make ethanol from wood and cellulosic biomass such as bagasse, wood chips and waste paper opens up an opportunity to utilize much cheaper feedstocks than starch and sugar based crops. Due to the high yield of ethanol from the process, and the low cost of the feedstock, the ethanol produced at the facility is expected to be economically competitive with fossil fuels[1]. Financing for the project is still pending. The Louisiana State Bond Commission approved the issuance of $120 million in bonds in February, 2000, but BCI couldn't find buyers for the bonds due to unfavorable market conditions. BCI has since switched to private financing and has secured $100 million of the $120 million needed to complete the project. As of now, construction is scheduled to begin in 2003 and start operating in mid-to-late 2004.

State Agriculture Commissioner Bob Odom was investigating the possibility of a 60 MM GPY ethanol plant near Lacassine, but the idea was scrapped when the estimated cost to build the plant came in too high. Dubbed "The Louisiana Green Fuels Project," the plant was to produce ethanol from sugar cane and other agricultural products and be constructed with proceeds from the sale of bonds. The bonds were to be paid off with profits from the sale of ethanol. Local officials are still working to keep the idea alive. With ethanol poised to replace MTBE as an oxygenate in reformulated gasoline and/or the passage of a federal renewable fuels standard (discussed later), the plant would probably find a healthy market for its ethanol.

National

The ethanol industry is growing with a record 2 billion gallons produced in 2002. Much of the current growth can be attributed to some states banning or considering banning the use of MTBE due to its propensity to contaminate ground water. MTBE is an octane enhancer and oxygenate that is used in over 80% of reformulated gasoline (RFG) to fulfill the federal oxygenate requirement for RFG. Ethanol is an alternative to MTBE used in about 15% of RFG. California was the first state to ban MTBE, although it has extended the deadline to 2004 out of fear of gasoline shortages. California petitioned EPA for a waiver of the oxygenate requirement for RFG but was turned down. New York has also petitioned the EPA for a waiver of the oxygenate requirement for RFG. They point to research that shows that RFG can be produced without oxygenates that meets Clean Air Act specs. The EPA has yet to rule in their case.

Other issues are also involved in the MTBE vs. ethanol debate. When blended in gasoline, the resulting gasoline has a one pound higher vapor pressure than gasoline blended with MTBE. This leads to increased evaporative emissions which is a component in ground level ozone (smog) production. This is generally only a problem in the summertime, thus the reason for vapor pressure limits for summertime RFG. When ethanol is blended with gasoline, pentane must be removed from the RFG base in order to comply with the vapor pressure limit. This causes a significant volume loss of the refiners stock and can lead to gasoline shortages and price spikes in areas using RFG made with ethanol. This is exactly what happened in the mid-west US during the summer of 2000[4]. Also, ethanol is soluble in water, and gasoline blended with ethanol will separate if contaminated with water. Pipelines usually contain some moisture. For this reason, ethanol must be shipped by train or truck and blended into gasoline near distribution points instead of blended at the refinery and shipped by pipeline.

The use of MTBE and ethanol in gasoline is largely the result of federal mandates, some of which may be about to change. After a failing last fall, the effort to revamp national energy policy has been resumed in the 108th Congress. Both House and Senate versions of an energy bill contain a renewable fuel standard which would require gasoline to contain a certain volume of renewable fuel. A renewable fuel standard would be a boon to the ethanol industry because the vast majority of renewable fuel used to meet the requirement would be ethanol. The House renewable fuel standard would require 2.7 billion gallons of renewable fuel in 2005 gradually increasing to 5 billion gallons by 2015. The Senate version would require 2.6 billion gallons in 2005 gradually increasing to 5 billion gallons in 2012. For perspective, total annual gasoline consumption is 130 billion gallons in the US and 2 billion gallons in Louisiana. Both versions include cellulosic biomass ethanol and biodiesel in their definitions of renewable fuel, and both versions consider one gallon of cellulosic biomass ethanol to be equivalent to 1.5 gallons of renewable fuel. Both versions also eliminate the oxygen requirement for RFG, but only the Senate version bans the use of MTBE (subject to state law). Overall, the language of the House and Senate energy bills are very similar. This makes it likely that an energy bill will be passed and sent to the president to sign. Even without passage of an energy bill, the ethanol industry is expected to continue to grow due to many states phasing out MTBE. Ethanol producers are gearing up and expanding to meet the increased demand for their product.

Energy Balance Update

The debate still rages over whether or not corn ethanol has a positive or negative net energy value (NEV). NEV is the energy contained in ethanol minus the energy required to produce the same volume of ethanol. Since the 1970's, many studies have been undertaken to calculate the NEV and results have varied greatly. Most of the newer studies report a positive NEV. Most recently, the USDA updated their 1991 study and came up with an NEV of 21,105 Btu/gal, up slightly from their 1991 study. The study is available online[3]. The newest USDA study identifies several factors that have led to the wide differences in NEV from different studies and found that most of the variation resulted from assumptions about farm production and ethanol conversion. According to the USDA study, studies that report negative NEV tend to use older data that do not reflect the advances made in farm production and ethanol plant efficiency.

1. University of Florida website: http://www.napa.ufl.edu/98news/ethanol.htm

2. LA Department of Natural Resources, Technology Assessment Division,
Phone: (225) 342-1270, E-mail: techasmt@dnr.state.la.us.

3. *The Energy Balance of Corn Ethanol: An Update*, U.S. Department of Agriculture, Office of Energy Policy and New Uses, Washington, DC; July, 2002.

4. "Environmental Impacts for RFG Without MTBE or Oxygenates". William J. Piel, TEIR Associates, Inc. 2000.

Originally Published in July 2003 Louisiana Energy Facts

SELECTED LOUISIANA ENERGY STATISTICS

Among the 50 states, Louisiana's rankings (in 2002 unless otherwise indicated) were:

PRIMARY ENERGY PRODUCTION
(Including Louisiana OCS)

1st in crude oil
2nd in natural gas
2nd in total energy

REFINING AND PETROCHEMICALS

2nd in refining capacity
2nd in primary petrochemical production

PRIMARY ENERGY PRODUCTION
(Excluding Louisiana OCS)

4th in natural gas
4th in crude oil
8th in total energy

ENERGY CONSUMPTION (2001)

3rd in industrial energy
3rd in per capita energy
3rd in natural gas
5th in petroleum
8th in total energy
22nd in residential energy

PRODUCTION

State controlled (i.e., excluding OCS) natural gas production peaked at 5.6 TCF per year in 1970, declined to 1.5 TCF in 1995, and rebounded 4.5% to 1.6 TCF in 1996. The 2000 gas production was, approximately, 1.46 TCF, the 2001 production was around 1.50 TCF, and the 2002 gas production was 1.36 TCF.

State controlled gas production is on a long term decline rate of 4.0% per year, though the current short term (2004-2008) forecast decline is around 5.3% per year.

State controlled crude oil and condensate production peaked at 566 million barrels per year in 1970, declined to 127 million barrels in 1994, recovered to 129 million barrels in 1996, and declined to 93.6 million barrels in 2002.

State controlled crude oil production is on a long term decline rate of 4.4% per year, though the current short term (2004-2008) forecast decline is around 5.0% per year. If oil stays around $25.00 per barrel, the decline will remain as predicted. If the price holds consistently above $25.00 per barrel, the decline rate may be lower.

Louisiana OCS* (federal) territory is the most extensively developed and matured OCS territory in the US.

Louisiana OCS territory has produced 90.5% of the 13.4 billion barrels of crude oil and condensate and 81.5% of the 143 TCF of natural gas extracted from all federal OCS territories from the beginning of time through the end of 2001.

Louisiana OCS gas production peaked at 4.16 TCF per year in 1979, declined to 3.0 TCF in 1989, and increased to 3.72 TCF in 2001.

Louisiana OCS crude oil and condensate production first peaked at 388 million barrels per year in 1972 and declined to 246 million barrels in 1989. In this decade, the production has steadily risen from 264 million barrels in 1990 to 502 million barrels in 2001 due to the development of deep water drilling.

REVENUE

At the peak of Fiscal Year (FY) 1981/82, oil and gas revenues from severance, royalties, and bonuses amounted to $1.6 billion, or 41% of total state taxes, licenses and fees. For FY 2002/03, these revenues are estimated to be in the vicinity of $731 million, or about 9% of total estimated taxes, licenses, and fees.

At constant production, the State Treasury gains or loses about $16 million of direct revenue from oil severance taxes and royalty payments for every $1 per barrel change in oil prices. This figure rises to $20 to $25 million per dollar change when indirect revenue impacts are included (e.g., income tax, sales tax, etc.).

DRILLING ACTIVITY

Drilling permits issued on state controlled territory peaked at 7,631 permits in 1984 and declined to a low of 1,017 permits in 1999. In 2001 there were 1,365 drilling permits issued, and in 2002 drilling permits fell to 1,025.

The average active rotary rig count for Louisiana, excluding OCS, reached a high of 386 rigs in 1981 and reached a low of 64 rigs in 1993. In 2000 the average was 69 active rigs, in 2001 it recovered to 108 active rigs, and in 2002 the average dropped to 76 active rotary rigs.

The 2002 average active rotary rig count for Louisiana OCS was 87 active rigs, 19 rigs, or 17.9% lower than 2001 average, and the highest active rotary rig count was 107 rigs recorded in 2000. In 1999, the average active rig count was 76, or 16.6% lower than the 1998 average active rotary rigs.

Note: Louisiana OCS or Outer Continental Shelf is federal offshore territory adjacent to Louisiana’s coast beyond the three mile limit of the state's offshore boundary.
TCF= trillion cubic feet

Originally Published in August 2003 Louisiana Energy Facts

Alternative Motor Vehicle Fuels in Louisiana

By Bryan Crouch, P.E.

The three major driving forces behind the usage of alternative fuels for vehicles are:

1) There is a desire to reduce our reliance on foreign sources of oil: Of the 15.17 million barrels/day (MMB/D) of crude refined in the US during 2000, the US imported 2.41 MMB/D from Arab OPEC, 2.13 MMB/D from non-Arab OPEC, and 4.52 MMB/D from non-OPEC countries. The September 11, 2001, terrorist attack accentuated the vulnerability of our vital oil supplies.

2) It can be a means of reducing motor vehicle pollution problems: Gasoline is a very efficient and convenient way to store energy. One pound contains 19,000 BTU, and simply pours out of a nozzle as a liquid at normal temperatures and pressure. The problem is, when gasoline is combusted with air, it produces carbon dioxide and a myriad of pollutants, such as oxides of nitrogen and carbon monoxide. The oxides of nitrogen, when exposed to sunlight, produce smog, a major health hazard.

3) There is a limited supply of current fuel sources: Although we keep discovering new oil and gas fields, supplies will eventually run out. Time estimates vary greatly, but inevitably that day will come.

The two major stumbling blocks to conversion to alternative fuels are:

1) There is a lack of a marketing infrastructure and fueling convenience: No other fuel has the distribution network of gasoline. Electricity and natural gas are readily available, but battery technology limits the use of electricity, and natural gas must be compressed or liquefied to be useful in vehicles.

2) The economics for most new fuels is unattractive: Alternative fuels, and alternative fuel vehicles (AFVs), are not cost competitive with gasoline at the present time.

Alternative fuel and AFVs have the potential to become less expensive as technology matures. Gasoline will become more expensive as crude oil supplies dwindle. At some point, the price curves will meet and the economics of alternative fuels will be competitive. Until then, federal and state incentives are being used to help spur the development and distribution of alternative fuels.

Federal and state legislative deadlines mandating the increased use of alternative fuels have spurred some Louisiana vehicle fleet owners to begin converting a portion of their fleets. Most new conversions are to compressed natural gas (CNG), but the majority of AFVs now on the road are fueled by liquefied petroleum gas (LPG), commonly known as propane. However, Louisiana Department of Revenue and Taxation records show a steady decrease in the number of these vehicles over the past few years.

Ecogas of Louisiana began the conversion of a portion of the state government fleet to CNG in March 1994 in accordance with their contract with the state. The contract was terminated in December 1995 after 184 conversions had been completed due to high costs and insufficient refueling infrastructure. Some city and parish governmental entities have converted a few vehicles in their fleets. For example, the Baton Rouge Department of Public Works has 61 CNG vehicles operating, with plans for more in the future.

Currently, there are four unrestricted public access CNG refueling stations and a few others willing to provide limited access with prior coordination. Public demand for personal natural gas vehicles (NGVs) remains virtually nonexistent due to the high cost of conversion and the lack of adequate refueling infrastructure participation.

There are several federal programs designed to increase the use of alternative fuels. One such program is the Department of Energy's (DOE) Clean Cities Program. Stakeholders of the Clean City organizations are motivated by voluntary measures, not by government mandates. The stakeholders, whether fuel providers, vehicle manufacturers, fleet managers, or air quality representatives, work together as a coalition to further the development of the AFV market.

State government offers tax incentives to encourage increased use of AFVs. Act 1060 of 1991 provides for a 20% tax credit for AFV purchases, certain conversion costs, and fuel dispensing facilities. Natural gas and LPG fuels also enjoy a lower state and federal tax rate compared to gasoline.

Much progress has been achieved in hybrid electric vehicle (HEV) technology, and the number of HEVs is beginning to increase. As battery performance and mechanical drive components continue to improve, and costs are reduced, we can expect to see more of these vehicles in use in Louisiana. Currently, only Honda and Toyota have hybrid cars that can be purchased, but models from several other manufacturers are in the works for 2004 and beyond.

Originally Published in October 2003 Louisiana Energy Facts

A Hydrogen Primer

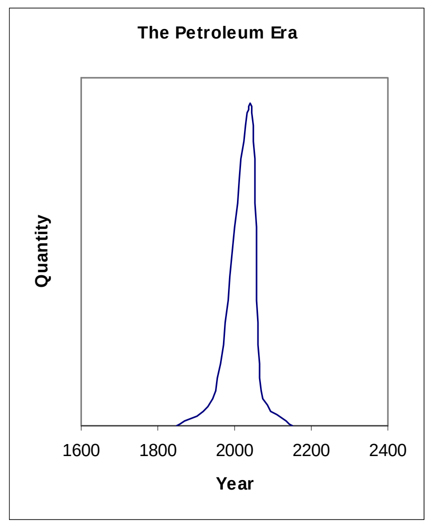
By Bryan Crouch, P.E.

The End of Cheap Oil

Energy is inextricably linked to our society and economy. We use energy as leverage for our physical strength and intellect to perform tasks we could not otherwise accomplish. Almost everything people do in the course of a day involves, or depends on, a machine using energy to produce work. Not just any energy will do, it must be affordable energy.

It has to be affordable because people are not interested in buying energy; they are interested in buying products and services. If the energy required to create products and services is unaffordable, the products and services become unaffordable. Currently, we get affordable energy from fossil fuels, a finite resource. Of the fossil fuels, oil is the most heavily relied on, but long before we run out of oil, we will run out of cheap oil.

At some point in the future, global oil production will peak and begin to decline. Some time after this, as demand rises and supply declines, prices will rise sharply. Prices will destabilize prior to this due to speculation and anticipation. Finally, prices will increase to a level beyond what the economy can support and the era of cheap oil, that began when Edwin Drake struck oil in 1859, will come to an end.



The world oil production curve will look something like the illustration on the right. The time frame for this sequence of events is the subject of much debate and speculation. The U.S. Department of Energy's Energy Information Administration predicts a peak between 2030 and 2075 (Energy Information Administration, 2000). Other experts on the subject predict a global peak ranging from 2000 to 2015 (Williams, 2003). The point is, whether the global peak occurs now, or 50 years from now, the petroleum era will be a short, finite blip in history.

The Hydrogen Economy

In order to maintain our economy and standard of living beyond the petroleum era, we will have to transition to some other energy regime. One possibility is hydrogen.

In 2002, the U.S/ Department of Energy released the National Hydrogen Energy Roadmap, and in 2003, President Bush announced $1.7 billion in funding for hydrogen energy in the State of the Union Address. Hydrogen has received a lot of attention lately, some portraying it as the cure-all for our energy problems, and some as an attempt to slash funding for research and development of other alternative energy sources.

The reasons for the wide ranging characterizations of hydrogen energy, other than political, are due to the fact that, in theory, hydrogen does indeed seem like a miracle solution to many energy problems, but many significant barriers exist to put it into practice. The following is an introduction to hydrogen and some of the possibilities and problems associated with a hydrogen based economy.

No one knows, yet, exactly what a hydrogen economy would look like, but the front running scenario would be based on hydrogen fuel cells producing electricity. The electricity would then be used to power vehicles, homes, businesses, etc. In this scenario, hydrogen is not an energy source, but rather a carrier. Hydrogen can, also, simply be used as a combustion fuel in an internal combustion engine. The only emission is pure water. Ford and BMW are actively pursuing this option as an alternative motor vehicle fuel.

Fuel Cells

A hydrogen fuel cell is a simple device that uses hydrogen and oxygen to produce an electric current. Sir William Grove is credited with the discovery of the fuel cell in 1839. His experiment was based on the known fact that, if an electric current was applied to water, it would separate into its constituents, hydrogen and oxygen (Figure 1). Grove's experiment simply showed that, if the electric current was removed, the reaction would reverse, and the hydrogen and oxygen would recombine into water and produce an electric current (Figure 2).

Figure 1

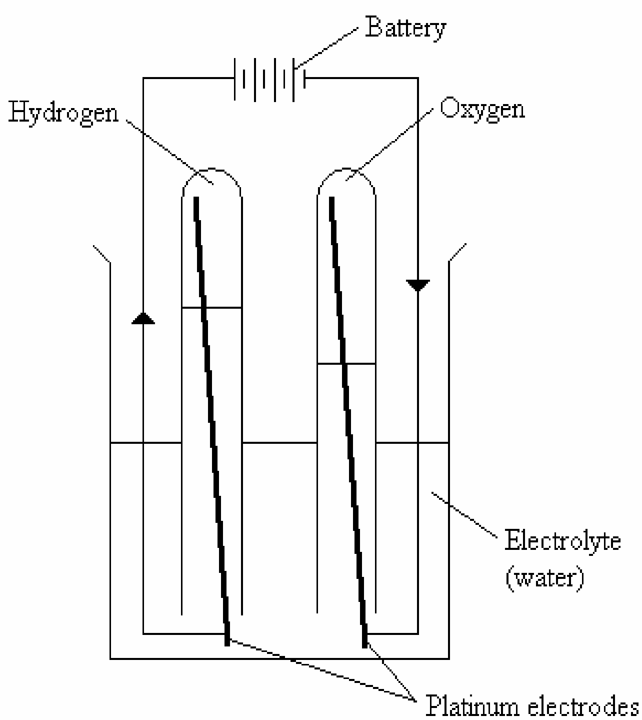
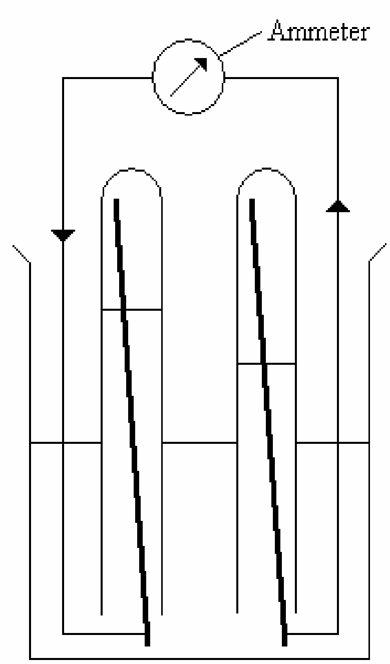
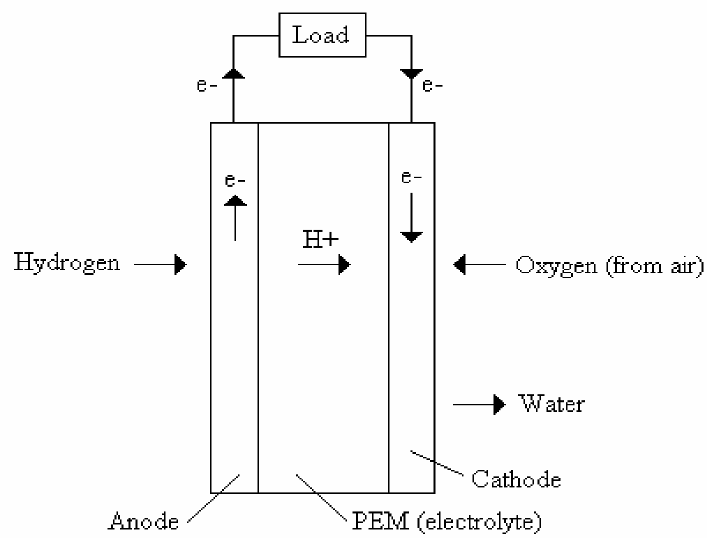


Figure 2



A practical fuel cell is more complex than the one shown in Figure 2, although the operating principle remains the same. One of the simplest types of a hydrogen fuel cell is the proton exchange membrane (PEM) fuel cell. A PEM is a specially designed polymer that functions as the electrolyte in the fuel cell assembly. The basic components of a PEM fuel cell are shown in Figure 3. Basically, a PEM fuel cell operates as follows: Hydrogen is fed to the anode and separated into hydrogen ions (protons) and electrons. The PEM allows the hydrogen ions to pass through to the cathode, but not the electrons. The electrons are given a separate path to the cathode, enabling electrical energy to be extracted. Oxygen is supplied to the cathode which combines with the hydrogen ions and electrons to form water. Another way of understanding the operation of a fuel cell is to think of the hydrogen as being "combusted," or oxidized, but, instead of producing heat energy, the reaction produces electrical energy. The voltage produced from this reaction is small, less than one volt. For this reason, several cells are connected in series, called a fuel cell stack, to produce the desired voltage. A typical PEM fuel cell is about 50% efficient, that is, it converts 50% of the energy contained in hydrogen into electricity. The efficiency can be increased substantially by capturing the waste heat and using it for space heating, water heating, or process heat. When the waste heat is utilized in a cogeneration setup, efficiencies can reach 90%.

Figure 3



Hydrogen Production and Transportation

The good news about utilizing hydrogen as an energy carrier is its abundance and its environmental benefits. The bad news is that it is always chemically bound to something else, usually oxygen and carbon. In order to obtain hydrogen, energy has to be exerted to break its chemical bonds with other elements. In general, with current technology, the energy required to obtain hydrogen renders the process uneconomical. While fuel cells have their own set of significant obstacles to overcome before being technologically and economically viable, the problems associated with obtaining and distributing hydrogen are generally thought to be more difficult to solve.

The ultimate objectives of hydrogen production for use as an energy carrier are producing it economically and renewably. There are several ways to produce hydrogen, some of them economical, and some of them renewable, but none that are both, as yet.

Over 9 million tons of hydrogen is produced yearly in the U.S. Most of it is used to make ammonia, while other users include refining, chemical, and food industries. Ninety five percent of this hydrogen is produced by using steam to reform natural gas (fossil fuels contain lots of hydrogen). This method can be economic, depending on the price of natural gas, but natural gas will eventually suffer a fate similar to that of oil since steam reformation of natural gas is a non-renewable source of hydrogen.

Renewable hydrogen production is accomplished by using renewable generated electricity (solar, wind, etc.) to perform electrolysis on water. Electrolysis, whether using renewable or non-renewable electricity, is inefficient, usually making it uneconomic. There are other ways of obtaining hydrogen including thermal water splitting, thermochemical water splitting, gasification of coal, and thermal and biological conversion of biomass. All of these methods are being investigated to determine their economic and technical feasibility.

The other major problem associated with hydrogen is transportation. Hydrogen gas is extremely lightweight, making it necessary to compress or liquefy it in order to be contained in a reasonably sized
volume for transportation by ship or truck. This adds considerably to the cost. Hydrogen can be transported effectively by pipeline, but few dedicated hydrogen pipelines currently exist. In the beginning stages, hydrogen will have to be produced on or near site. As hydrogen usage expands, the economics will change and, depending on technological advances, central hydrogen production may make sense.

Transition and the Future

This discussion, so far, focuses on the current state of hydrogen in relation to its use as an energy carrier. It’s clear that a hydrogen based energy regime will have to begin with the non-renewable production of hydrogen for economic reasons. As the transition to a new energy regime occurs, the technology and economics will change, hopefully leading to the economic, renewable production of hydrogen. For example, hydrogen will accelerate the development of wind and solar power by enabling the storage of energy produced by these intermittent sources. This would allow wind and solar to move into geographic areas that are not, otherwise, ideal for their usage. Another renewable technology that may mesh well with hydrogen is off shore geothermal electricity generation. This technology uses the temperature difference in water depth to drive a thermodynamic cycle and generate electricity. Although the process is extremely inefficient, the size of the resource is huge, including all tropical oceans and the Gulf of Mexico. The electricity can then be used to electrolyze sea water to produce hydrogen, which is then liquefied and shipped to shore for distribution.

The Louisiana Connection

Whether or not hydrogen proves to be the foundation of future energy production, a lot of resources are being directed towards hydrogen and fuel cell development. Louisiana is one of the few places in the country that has an existing hydrogen infrastructure. Air Liquide, Air Products, and Praxair operate hydrogen pipelines in Louisiana, and Louisiana is home to many chemical plants and refineries that produce and use hydrogen. The existence of this hydrogen market creates a ripe environment for hydrogen and fuel cell development. If taken advantage of, Louisiana could become a hub of hydrogen and fuel cell development. For example, in the largest fuel cell transaction to date, Dow Chemical and General Motors recently announced a deal in which GM will provide fuel cells to the Dow plant in Freeport, Texas. Dow will use excess hydrogen generated as a byproduct from chlorine production to feed the fuel cells. The electricity generated by the fuel cells will be used for general power in the plant. The fuel cells are expected to produce 35 megawatts of power over the life of the project. Dow and GM are discussing plans for similar projects at other Dow plants.

We will still be using fossil fuels well into the future, but, eventually we'll have to derive energy from some other source. A lot will be at stake for Louisiana when this happens. Everyone knows what would happen to Louisiana's economy if the oil and gas industry weren't here. If electricity produced via hydrogen turns out to be the alternative, and we take advantage of the opportunity, Louisiana could continue its role as a leader in energy production and technology well into the future.

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AMERICA'S WETLANDS: ENERGY CORRIDOR TO THE NATION

By Bob Sprehe, Energy Economist

A Proud History of Service to America's Energy Needs

Part 1 of a series of 7 articles

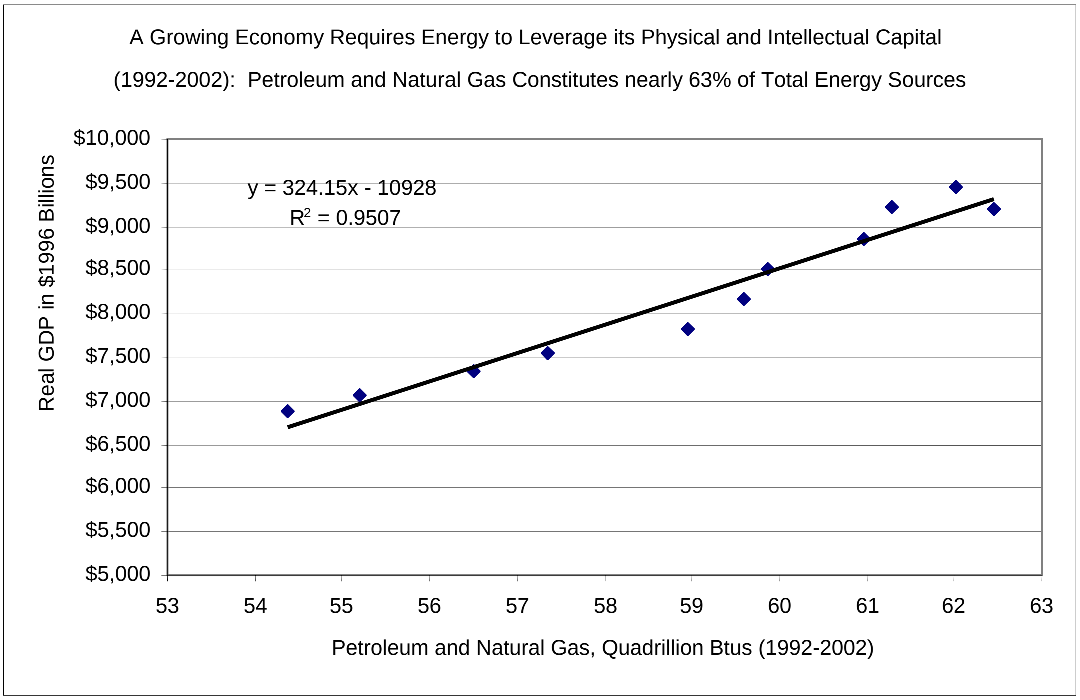
Louisiana's coastline measures just under 400 miles from the Texas border to the Mississippi line. This represents less than 6% of the contiguous lower 48 states' coastline. From this coastline up to Interstate 10, which traverses the state east to west, lies about 5,300 square miles (or 3.4 million acres) of coastal wetlands (America's Wetlands).

Within, and across, this wetlands area are:

1) oil and natural gas drilling slips and production facilities,
2) natural gas and crude oil pipelines, both onshore and from the state and federal offshore,
3) the intersections of oil and natural gas intrastate and interstate pipeline networks, from both onshore and offshore, which serve as the reference for Wall Street's Commodity Futures markets such as the Henry Hub for natural gas, the St. James Louisiana Light Sweet Crude Oil, and the Mars Sour Crude Oil contracts,
4) subsurface salt domes which store a significant portion of the nation's Strategic Petroleum Reserve (SPR),
5) the St. James oil terminal on the Lower Mississippi River, capable of offloading ocean going oil tankers, or loading barges for further inland shipment, and the origination of Shell Oil Company's CAPLINE pipeline network transporting oil and petroleum products north into the nation's heartland,
6) the Louisiana Offshore Oil Port (LOOP), the nation's major import terminal for foreign oil, the associated east-west LOCAP pipeline network, and onshore salt dome storage facilities,
7) an LNG (liquefied natural gas) terminal, site of one of the nation's major import facilities for natural gas and, now,
8) Port Fourchon, near the termination of Louisiana Highway 1 at Leeville, Louisiana, located directly on the Gulf Coast, the oil field services and supply port supporting the deepwater offshore exploration and production efforts, the only growing source of domestic crude oil production in the United States.

This compact coastal geographic area of the United States and its network of energy facilities, in the aggregate, accommodate the movement of over 26% of the nation's natural gas supply, as well as, over 26% of the nation's crude oil supply. Together with the facilities in the rest of the state, nearly 34% of the nation's natural gas supply, and over 29% of the nation's crude oil supply, moves through the state of Louisiana and is connected to nearly 50% of U. S. refining capacity. Not considering other value, this volume of crude oil and natural gas flowing through Louisiana's Energy Corridor represents, approximately, $150 billion in annual energy value, equivalent to about $50,000 per acre of wetlands (about $30,000,000 per square mile). **No other similar sized geographic area of the United States impacts the nation's aggregate economy like this vital Wetlands Energy Corridor.**

U. S. Citizens use Energy to Leverage their Physical and Intellectual Capital and to raise Living Standards. Crude Oil and Natural Gas are the primary sources of that energy.



Louisiana's Proud Energy Heritage

Col. Edwin L. Drake is widely credited with drilling the first successful oil well in the United States, near Titusville, Pennsylvania in 1859. This is acknowledged in history as the beginning of the oil industry in America.

But Louisiana has been a vital participant in this nation's proud energy history for over 130 years, spanning parts of the 19th, 20th and 21st Century.

An Historical Timeline of Louisiana's Wetlands Resources as America's Energy Corridor

Year	Event
1868	Louisiana's first well, an exploratory well near Bayou Choupique, Hackberry, LA was a dry hole.
1901	The No. 1 Jules Clement, 5 miles northeast of Jennings, completed as a producer Sept. 21, 1901.
1906	First North Louisiana well (natural gas) completed March 26, 1906 in Caddo Parish.
1906	First interstate natural gas pipeline system from Caddo Field to Marshall, TX.
1909	First processing at Baton Rouge refinery, September 1909.
1910	First interstate oil pipeline from Oklahoma through Caddo Lake area to Baton Rouge.
1910	Gulf Oil completes the first oil well over water in Caddo Lake, 1910.
1933	First well drilled on state offshore lands, 3,000 ft. from the beach near Creole, LA, in 12 ft of water.
1937	First offshore field production in 26 ft. of water, 1.5 miles off the beach, Creole, LA.
1947	First offshore well drilled out of sight of land by Kerr McGee in Ship Shoal Block 32.
1976	Shell Oil announces discovery of first deepwater field, called Cognac, in 1,025 ft. of water at Mississippi Canyon 194.
1977	DOE SPR initiative completes St. James terminal and salt dome storage facility at Bayou Choctaw.
1979	A consortium of private companies completes the Louisiana Offshore Oil Port, salt dome storage, and LOCAP pipeline.
1981	Panhandle Eastern Pipeline company completes its LNG terminal at Lake Charles, LA.
1991	State of Louisiana organizes the Louisiana Oil Spill Coordinators Office to pro-actively manage spill threats to Wetlands Resources.
1997	Port Fourchon, the nation's only port serving the deepwater oil and natural gas infrastructure, expands operationally.
2001	Thunder Horse, largest deepwater reservoir yet discovered (in 5,640 ft. of water) is announced by owners BP and Exxon.
2002	Marathon and TotalFinaElf set water depth record for natural gas pipeline tie in (7,209 ft. water depth).
2002	MMS implements Presidential Directive to fill SPR with Royalty in Kind Oil, rate reaches 100,000 BOPD in October 2002.
2002	ChevronTexaco files first LNG proposal under the Deepwater Ports Act with the USGS on December 3, 2002 (Port Pelican).

In 1868, 9 years after Col. Drake drilled his first discovery, a dry exploration well was drilled near Hackberry, LA. Instead of oil, sulfur was discovered. (Source: Morning Advocate, October 10, 1956, “Oil Progress Week Begins, History of Oil is Related”)

Louisiana’s first oil discovery was on September 9, 1901 near Jennings, LA, about 9 months after the discovery of the legendary Spindletop field near Beaumont, TX. (Source: Morning Advocate, October 10, 1956)

In 1906, the first gas well was completed in Caddo Parish by a group of Chicago businessmen in the synthetic gas business. (Source: *Natural Gas*, *The Gulf South’s Symbol of Progress* by Norris Cochran McGowen, member of the Newcomen Society, President of United Gas Corporation, 1951)

Later that same year (1906), the first interstate natural gas pipeline was laid from the Caddo field to Marshall, Texas. (Source: Natural Gas, McGowen)

In 1909, oil refining started in Baton Rouge at, what is today, the site of the giant Baton Rouge refinery. (Source: Morning Advocate, October 10, 1956)

In 1910, the first interstate oil pipeline was completed from Oklahoma to Baton Rouge, running through Caddo Parish and incorporating the oil production from the Caddo field. (Source: *Louisiana Oil and Gas Facts*, Mid-Continent Oil and Gas Association, 30th Edition).

Also in 1910, Gulf Oil completed the first well drilled over water in Caddo Lake. (Source: Louisiana Department of Natural Resources, Office of Conservation web site, Centennial Slide Show, “First 100 Years”)

In 1933, the first well drilled on state offshore lands was drilled at Creole, LA, approximately, 3,000 ft. off the beach in 12 ft. of water. (Source: Jim Lavin, Louisiana Department of Natural Resources, Office of Mineral Resources [OMR], Petroleum Lands)

In 1937, the first offshore field was placed on production at Creole, LA, about 1.5 miles offshore in 26 ft. of water. (Source: Jim Lavin, Louisiana Department of Natural Resources, Louisiana Department of Natural Resources, OMR)

In 1947, the first offshore well, out of sight of land, was drilled by Kerr-McGee Oil Company at Ship Shoal Block 32. (Source: Jim Lavin, Louisiana Department of Natural Resources, OMR)

In 1976, Shell Oil Company announced the first deepwater discovery at their Cognac platform in Mississippi Canyon Block 194 in 1,025 ft. of water. (Source: Minerals Management Services, MMS, Milestones, Directors’ page web site)

In 1977, the Department of Energy opened its St. James docking and terminal facilities and its Bayou Choctaw Strategic Petroleum Reserve (SPR) salt dome storage site to commercial operation. (Source: Department of Energy, DOE, Fossil Fuels web site)

Two years later, in 1979, a consortium of private energy firms opened the Louisiana Offshore Oil Port (LOOP) for commercial operations, including underground salt dome storage and the LOCAP pipeline connecting with the already operational CAPLINE complex, and extending east-west to refineries within Louisiana, and across the borders to Texas and Mississippi. (LOOP web site)

In 1981, Panhandle Eastern Pipeline Company completed its Liquefied Natural Gas (LNG) Storage and Regasification facilities at Lake Charles, importing LNG from Algeria by specially constructed LNG tankers for resale to the Midwest natural gas markets. (Source: *Louisiana Contractor* magazine, July 1980, “Liquefied Natural Gas Has A Role in the Energy Crisis and a Base in Louisiana”)

With Congressional passage of the Oil Pollution Act of 1990 (in response to the Exxon Valdez oil spill off the coast of Alaska), the Louisiana State Legislature created the Louisiana Oil Spill Coordinators Office (LOSCO) in 1991 to pro-actively manage the state’s environmental exposure to spills from the myriad pipeline, shipping, drilling, and producing locations, particularly in, and near, the environmentally sensitive coastal wetlands areas. (Source: Louisiana Oil Spill Coordinators Office brochure, Office of the Governor, State of Louisiana)

As the deepwater discoveries increased in numbers, the nation’s only port serving the exclusive needs of the deepwater oil and natural gas exploration and production sector, Port Fourchon, near Leeville and Grand Isle, Louisiana expanded its land based facilities to meet the escalating needs of deepwater operators and American consumers.

In 2001, BP and Exxon announced the largest deepwater oil discovery to date in the Gulf of Mexico, located in 5,640 ft. of water, called Thunder Horse. (Source: MMS Milestones)

In 2002, Marathon and TotalFinaElf marked another milestone for deepwater operations by successfully installing a natural gas pipeline tie in 7,209 ft. of water. (Source: MMS Milestones)

In October 2002, the Minerals Management Service (MMS) implemented a Presidential Directive to fill the Strategic Petroleum Reserve (SPR) by taking Federal Government royalties "in kind", achieving a fill rate of 100,000 barrels oil per day (BOPD). (Source: MMS Milestones)

In December 2002, ChevronTexaco filed the first application for permit under the Federal Deepwater Ports Act for an LNG terminalling facility in the Gulf of Mexico, initially to be known as "Port Pelican." (Source: MMS Milestones)

Subsequent to the Chevron filing, natural gas supply and pricing has received much public attention, largely because of the special testimony of Federal Reserve Board Chairman Alan Greenspan to Congressional panels on the critical role of natural gas in the Nation's economy.

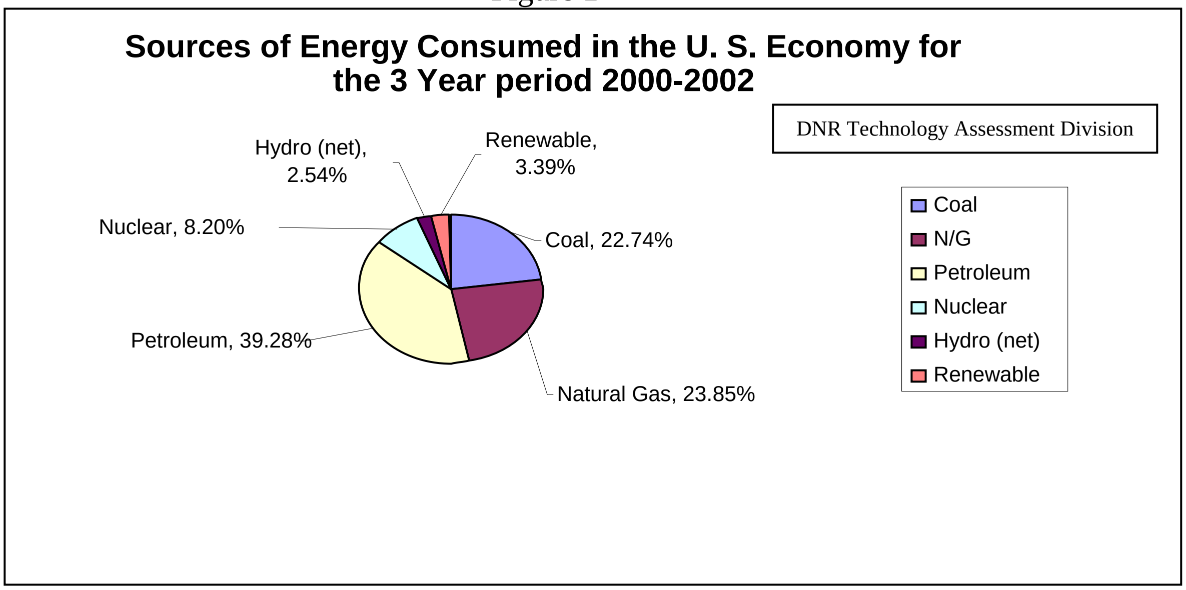
NOTE: The Department of Natural Resources wishes to thank the Research Librarians at the State Library of Louisiana for their assistance in locating these many references.

The Department of Energy's (DOE) Strategic Petroleum Reserve (SPR)

Part 2 of a series of 7 articles

The U. S. uses energy to leverage its physical and intellectual capabilities to raise living standards. Nearly 63% of that energy comes from crude oil and natural gas. These two fossil fuels, especially crude oil, have dominated the energy supply equation for the U. S. economy, not only in the past 100 years, but likely into the foreseeable future.

Figure 1



The importance of crude oil imports to the U. S. economy becomes quite clear from the American Petroleum Institute (API) data tracing historical crude oil production and imports (Figure 2). Over 56% of America's supply of crude oil now comes from foreign imports. With this magnitude of import reliance, the need for a strategic reserve of crude oil supply as a hedge against supply disruptions which could destabilize the U. S. economy is readily apparent.

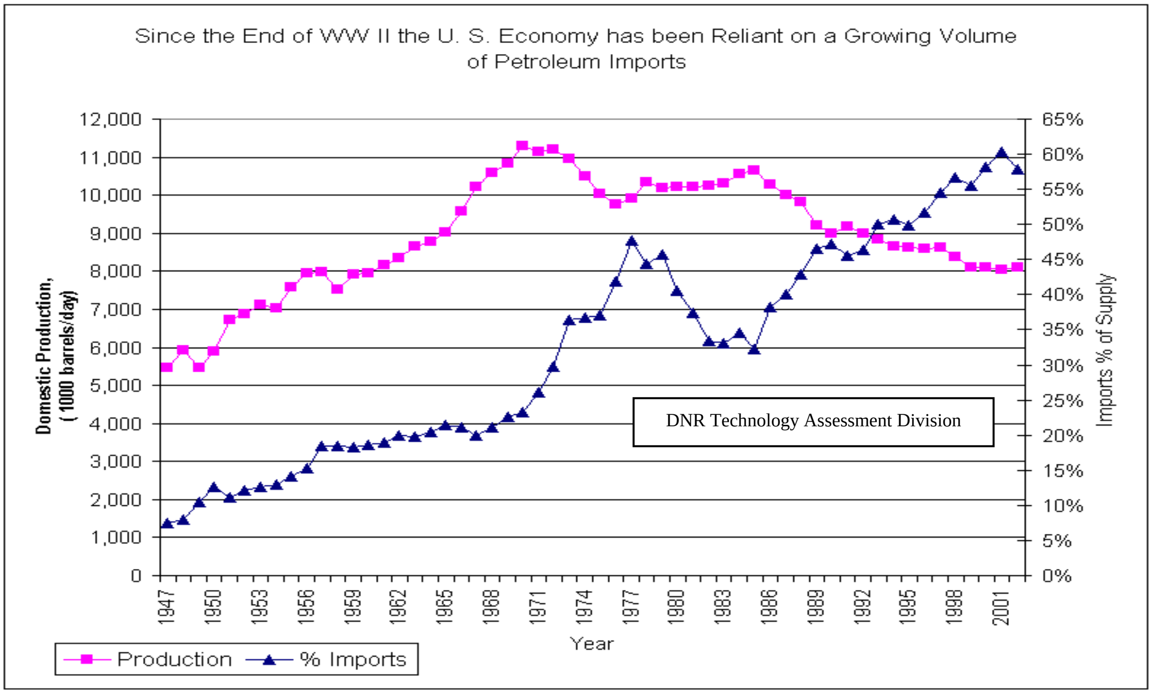
History of Strategic Oil Reserve Policy Discussions

The DOE web site, *Fossil.Energy.gov*, details the history of policy discussions within Administrations since 1944 and is the primary source for a wealth of knowledge about the SPR.

> "Secretary of the Interior Harold Ickes advocated the stockpiling of emergency crude oil in 1944. President Truman's Minerals Policy Commission proposed a strategic oil supply in 1952. President Eisenhower suggested an oil reserve after the 1956 Suez Crisis. The Cabinet Task Force on Oil Import Control recommended a similar reserve in 1970."

But the Arab oil embargo of 1973-74 triggered action. President Ford signed the Energy Policy and Conservation Act (EPCA) on December 22, 1975. This legislation declared it to be the policy of the United States to establish a reserve of up to 1 billion barrels of petroleum.

Figure 2



Louisiana's Wetlands Energy Resources

Because of the existence of a concentration of refineries and distribution points for tankers, barges, and pipelines along the Gulf of Mexico it was logical to look for storage in this geographic area. A large number of subsurface salt domes were identified across Louisiana, Texas, and Mississippi. The subsurface storage of crude oil in salt caverns offered the best security for the Strategic Petroleum Reserve (SPR), low environmental risk, and also the least costly storage mechanism, as salt dome storage is considered about one-tenth the cost of surface storage of crude oil.

Storage locations along the Gulf Coast in Louisiana and Texas were selected because they provided the most flexible means for connecting the SPR storage sites to the existing commercial pipeline and waterways network, subsequently reaching over 50% of the nation's refineries.

In April 1977, the government acquired several existing salt caverns to serve as the first storage sites. Sites were acquired at 3 locations: Bayou Choctaw, near St. James, Louisiana; West Hackberry, near Hackberry, Louisiana; and Bryan Mound, near Freeport, Texas. In 1982, a fourth complex was added, the Big Hill Storage site near Nederland, Texas. Surface facility

construction at Bayou Choctaw and St. James, Louisiana began in June 1977. On July 21, 1977, the first oil was delivered to the SPR, a shipment of Saudi Light crude.
The SPR, currently, has 62 caverns for storage of the SPR crude oil reserve. These salt caverns range between 6 and 30 million barrels in capacity. A typical cavern contains 10 million barrels, is cylindrical in shape, has a diameter of about 200 feet, and a height of about 2,000 feet. The caverns are created by drilling into the salt dome, then circulating fresh water to dissolve the desired cylindrical shape.

President Bush has authorized filling the reserve up to its current capacity of 700 million barrels. The SPR is currently receiving oil and will reach that storage capacity by the 4th Quarter of calendar year 2005. Currently, there are 618.4 million barrels of crude oil in SPR inventory. The priority in managing the SPR, under the direction of the Office of Fossil Fuels, is to maintain the readiness of the oil stockpile for emergency use at the President's direction. The current maximum draw down rate is 4.35 million barrels per day.

The St. James, Louisiana Marine Terminal

Surface facilities for oil cargo handling were also needed to sustain the ongoing operation of the subsurface salt dome storage facilities. DOE constructed a marine terminal site in St. James, Louisiana, St. James Parish at mile marker 158.3 on the Mississippi River, approximately, 45 miles west of New Orleans and 30 miles southeast of Baton Rouge, Louisiana. Marine site construction began in 1978 and was completed in 1980. The facilities comprise 2 main sites: "a main terminal occupying, approximately, 105 acres of land, and 2 marine docks occupying, approximately, 48 acres of land."

"The main terminal consists of 6 surface storage tanks totaling 2,000,000 barrels of capacity, crude oil pumping stations, metering stations, and control and maintenance facilities.

Each marine dock is capable of berthing up to 123,000 Dead Weight Ton (DWT) vessels. Vessel loading or unloading is at the rate of 40,000 barrels per hour at pressures from 50-150 pounds per square inch gauge (psig). Oil Barges may also be loaded at Dock 1 at rates ranging from 3,000 barrels per hour to an 8,000 barrel per hour rate.

These surface facilities also have their own award winning, trained fire fighting crews and fire protection system. Likewise, each of the dock platforms has been designed to contain a 666-barrel oil spill before overflowing. Additional containment equipment stored at the terminal includes, approximately, 2,000 feet of containment boom, and several boats for immediate spill boom deployment and oil spill containment.

SPR: From Louisiana's Wetlands to Wall Street

The Strategic Petroleum Reserve (SPR) is now 25 years old (1978 - 2003). Current capital improvements will extend the operating life to the year 2025.

SPR staff benchmark their operation against similar international facilities. The SPR is the lowest cost operation of its kind in the world.

Cost Categories	Cost Range
Storage Development Cost	\$4.50 - \$5.00/barrel (bbl)
Operating Costs	\$0.205/bbl
Drawdown Costs	\$0.15/bbl

Not only does the Department of Energy (DOE) SPR staff maintain efficient economic operations, but their environmental record has earned award winning performance. Each site has an emergency response team equipped to respond should an emergency situation develop.

DOE's SPR is a responsible operator in Louisiana's Wetlands. This is yet another example of the successful coexistence of oil and gas operations within a sensitive environmental setting while complying with State laws and regulations.

This successful coexistence then facilitates a crucial consumer service: a price discovery mechanism for Wall Street which further facilitates least cost delivery of energy products to America's Consumers.

A most important role for the St. James terminal location, and associated pipeline intersections, is in representing the standards for two forms of Futures contracts in crude oil: (1) St. James Light Sweet Crude Oil, and (2) Mars Sour Crude Oil. Both of these are reference contracts on the New York Mercantile Exchange (NYMEX). [For further information on this Futures market reference see Part 3 of this 7 Part series].

The current SPR inventory by type of crude oil, as of September 8, 2003, was:

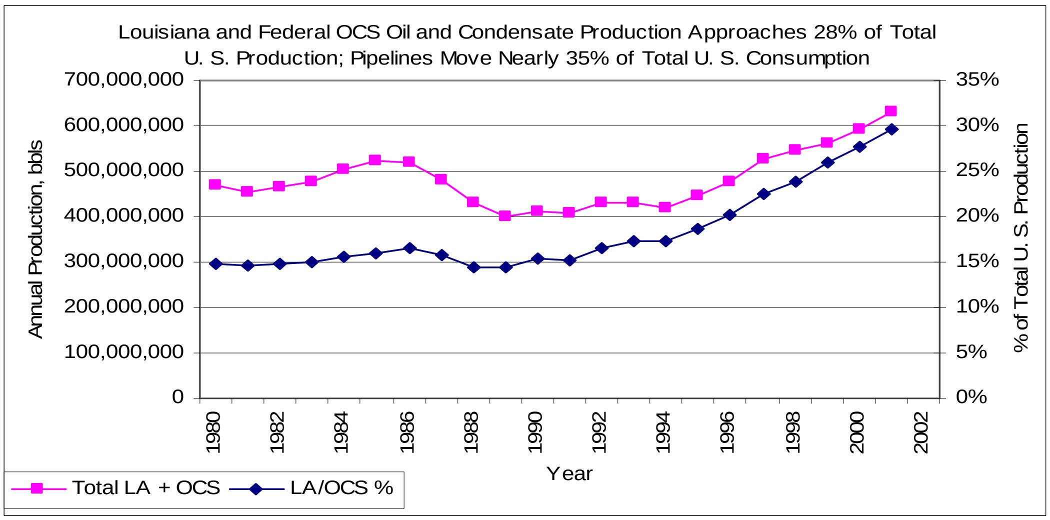
Sweet	233.8 million barrels
Sour	384.6 million barrels
Total	618.4 million barrels

NOTE: The Department of Natural Resources wishes to thank the Department of Energy for its cooperation in assembling this part of our 7 part series. We would especially like to thank the retired Deputy Assistant Secretary for Petroleum Reserves, Richard Furiga and Director of Planning and Engineering, Dave Johnson, of Washington, D. C.; Special Assistant to the SPR Project Manager, Ann Rochon, Director, Crude Oil, Drawdown Readiness, and Cavern Integrity Division, Nabil Shourbaji, and Petroleum Engineer, Robert Myers, all from the New Orleans office; and to the Research Librarians at the State Library of Louisiana.

The Louisiana Offshore Oil Port (LOOP) and Connected Interstate Delivery Network

Part 3 of a series of 7 articles

As the nation's reliance on imports has grown, so too has the domestic reliance on increased deepwater production, much of it flowing through the LOOP offshore facility to shore.



History of LOOP

In 1972, just as U. S. production peaked and oil import growth accelerated (see graph in Part 2 of this 7 part series), several major oil companies with growing reliance on imported oil to fuel their own refineries organized a company for the purpose of constructing and operating an oil import terminal. The new maritime construction and shipping technology of ultra large crude oil carriers (ULCC), and very large crude carriers (VLCC), was changing the economics of oil transport. LOOP's license to construct and operate the deepwater port was issued in 1977.

As with the Strategic Petroleum Reserve (SPR), the most likely location for such a terminal was along the Gulf Coast within the arc of the bulk of the nation's refining capacity in Louisiana and its east-west bordering states, Texas and Mississippi, and where access to salt dome storage would safely lower the capital and operating costs of large inventories of crude oil.

Since bringing these ULCCs and VLCCs into an onshore port was both risky, as well as politically sensitive, and offloading their cargo into smaller tankers in deeper water was inefficient and expensive, it was logical to think in terms of an offshore location away from land. These ULCC and VLCC ocean going vessels can carry as much as 4.2 million barrels of crude oil, draw an 85 foot draft, range in length up to 1,500 feet and 280 feet in width. The location selected was in the Gulf of Mexico about 18 miles south of Leeville and Grand Isle, Louisiana in

110 feet of water, and already the site of considerable drilling and production activity at Bay Marchand.

Construction began in 1978. LOOP became operational in 1981. LOOP operates under both a Federal and a State of Louisiana regulatory regime. The Coast Guard coordinates all federal agency activity relative to deepwater ports, and the Louisiana Offshore Terminal Authority (LOTA) performs the same on behalf of the State of Louisiana.

LOOP's environmental record has been exemplary. There has been no major oil spill since operations began in 1981. The LOOP Environmental Monitoring Program is conducted on a routine basis to insure there are no adverse environmental impacts resulting from the operation of the facility.

The current owners of LOOP are Ashland Inc., Marathon Ashland Pipe Line LLC, Murphy Oil Corporation (a major refiner of crude oil), Shell Pipeline Company LP and Shell Oil Company (a major international oil company), and the American unit of Royal Dutch Shell of the Hague, Netherlands.

Louisiana's Wetland Resources Ideal for LOOP Facilities

LOOP's offshore facilities comprise the Marine Terminal (two platforms; one pumping, the other control and living quarters), and three single point mooring buoys (SPM). Tankers from around the world including, but not limited to, the Middle East, West Africa, the North Sea, Columbia, South America, Mexico and Russia deliver crude oil to LOOP. These tankers tie up to the SPM buoys and are able to operate in, virtually, all weather and current conditions.

The Marine Terminal has four 7,000 horsepower (HP) pumps available for offloading tankers. The Marine terminal can accommodate 100,000 barrels per hour flow rates. Approximately, 365,000,000 barrels per year of imported oil flow through this offshore terminal. Oil flows to shore through a 48" pipeline. A booster station is located at Fourchon, the point where the 48" line comes ashore (near Leeville, Louisiana on the Gulf of Mexico). The Fourchon booster station is powered by four 6,000 HP pumps. Fourchon also has the facilities to pump diesel through a 4" line out to the Marine terminal for fuel supply.

Oil flows 25 miles inland from the Fourchon station to the Clovelly terminal through a 48" pipeline. LOOP has over 48,000,000 barrels of subsurface salt dome storage capacity at the Clovelly Dome Storage Terminal.

The subsurface storage capacity is contained in eight subsurface caverns, each with more than 5,000,000 barrels capacity. There is a 25,000,000 barrel surface brine storage reservoir at the Clovelly terminal. Brine is pumped into the caverns to displace the oil from them for transport through the connecting pipeline system to other pipelines and on to refineries. When oil is pumped into storage, brine is displaced into the brine reservoir. The brine storage reservoir covers 220 acres.

All of this flow is controlled by Oil Movement Controllers (OMCs), stationed at LOOP's control center located in Galliano, Louisiana. Like the Marine terminal, the control center is manned 24 hours per day.

LOOP also operates a 53 mile, 48" pipeline system connecting the Clovelly site to the St. James, Louisiana terminal. Through these interconnections, and four other pipeline connections onshore, LOOP handled crude oil can reach nearly 50% of the nation's refining capacity, from within Louisiana, to the Texas City area to the west, and to the Midwest and Upper Midwestern part of the United States through the 40" Capline system. LOOP can, also, access three of four SPR sites. (Note: When the SPR is included, flow reaches nearly 50% of the nation's refining capacity.)

The Deepwater Connection

Shell Oil Company has made several discoveries in the Mississippi Canyon area of the deepwater Gulf. Shell's production from Ursa, Mensa, and Mars platforms commingles with production from the Amberjack pipeline volumes to make up the MARS Blend sour crude oil ("sour" referring to sulfur content).

The MARS pipeline system takes its production from these deepwater offshore platforms to LOOP's Clovelly terminal and, subsequently, flows on to the refineries just as the imported oil is handled.

British Petroleum (BP) operates the Thunderhorse discovery in the deepwater Gulf. Thunderhorse is the largest oil discovery to date in the deepwater. Thunderhorse oil will be pumped to the LOOP Clovelly terminal then, subsequently, on to refineries as MARS and the imported oils are handled.

The NYMEX Connection

Producers of commodity type products use a Commodities Futures Market to better manage their price and volume risk as they sell and buy products with various counterparties—counterparties are the other parties to the transaction, be it buying or selling. To become a reference point for crude oil on the Futures Exchanges, such as the New York Mercantile Exchange (NYMEX), the facilities to handle a large volume of oil product of a consistent grade and to transport said product to many points, is essential. This is what the LOOP and St. James terminal locations offer. St. James is a major crude oil gathering, trading, storage, and distribution hub for, approximately, 2,000,000 barrels per day of crude oil. The St. James hub is one of the world's premier trading hubs.

The contracts are referenced at St. James: (1) the Louisiana Light Sweet Crude Oil (LLS), and (2) MARS Blend Sour Crude Oil (MARS) is referenced at LOOP. The LLS crude is a high quality premium crude oil, low in sulfur content. The MARS Blend is a medium sour blend crude and serves as a price reference with Kuwaiti Medium, Arab Medium, and Latin American sour crude oils, linking it to the world market. Both types of crude oil flow at a rate of about 400,000 barrels per day through the St. James hub.

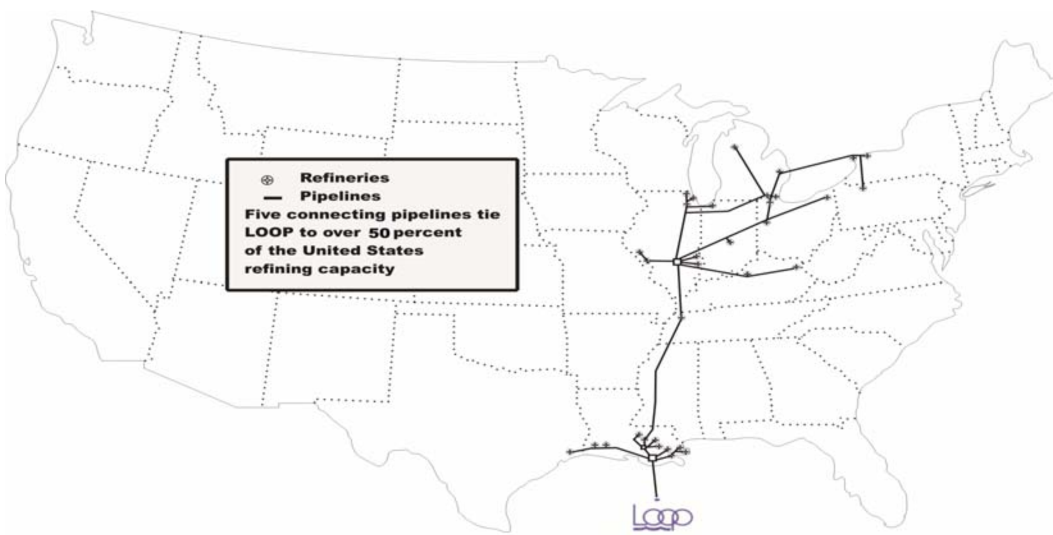
Capline

Several major pipelines transport crude oil out of Louisiana in north, east, west, northwest, and northeast directions. But of these entire pipeline delivery systems, one of the most important is the Capline system, operated by Shell Pipeline Company. Capline delivers crude oil to the important consumption areas of the Midwestern markets, serving refineries near Memphis, St. Louis, Chicago, Detroit, Toledo, Cleveland, Canton and Ashland (Kentucky). Capline has a flow capacity in excess of 1,100,000 barrels per day from the St. James terminal hub.

America's Wetlands: Energy Corridor to the Nation

Taken together, LOOP, LOCAP, SPR, Bayou Choctaw, St. James, Capline and the NYMEX financial market connections, the Louisiana Wetlands Resources play an extraordinarily prominent role in the daily life and financial stability of America's consumers, corporations, and the nation's energy security.

A Schematic of the Geographic Area Served through Louisiana's Wetlands Resources



NOTE: The Department of Natural Resources wishes to thank the staff of the Louisiana Offshore Oil Port (LOOP) for its cooperation in assembling this part of our 7 part series, as well as, the Louisiana Offshore Terminal Authority (LOTA), Department of Transportation and Development, Baton Rouge, LA, and the Research Librarians at the Louisiana State Library.

Originally Published in November 2003 Louisiana Energy Facts

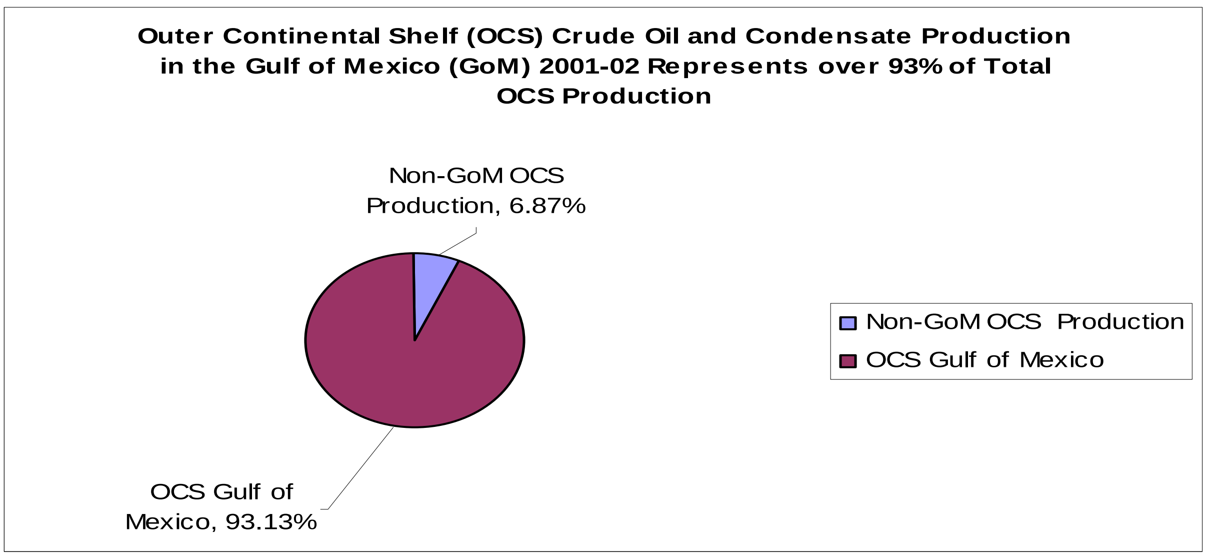
The Louisiana Oil Spill Coordinator's Office (LOSCO): A Responsible Steward of Wetland Resources

Part 4 of a series of 7 articles

Federal Oil Pollution Act of 1990

The year 1989 was a year filled with international events of global impact, the Exxon Valdez oil spill off the Alaskan coast was one such event. The spill triggered passage of the Federal Oil Pollution Act of 1990 (OPA) (33 USC 2701 *et seq*) which incorporated into OPA the requirement for a national contingency plan for cleanup of oil spills and discharges. The Act includes provisions relating to the responsibilities of state agencies designated as natural resources trustees.

Production of oil and condensate in the Gulf of Mexico Outer Continental Shelf (OCS), off of the Louisiana Coast, exceeds 93% of total OCS production in years 2001-2002



Louisiana Recognizes it's Environmental and Energy Challenges and Responsibilities

In working with the energy industry, Louisiana has learned that it is possible to live in harmony with the twin goals of environmental protection, and energy exploration and production.

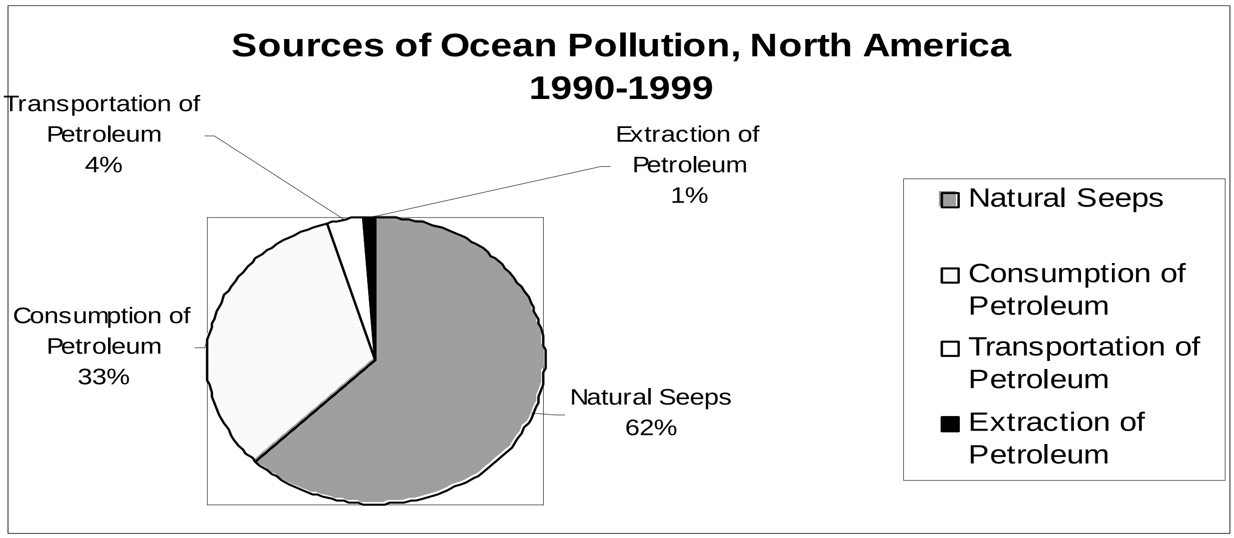
The National Academies Ocean Studies Board Report "Oil in the Seas III", Copyright 2002, noted " …improved production technology and safety training of personnel have dramatically reduced both blowouts and daily operational spills. Today, accidental spills from platforms represent about one percent of petroleum inputs in North American waters and about three percent worldwide."

Petroleum Released to the Marine Waters by Source, 1990-1999 in Thousands of Tonnes

	Best Estimates North America	%	Best Estimates Worldwide	
Natural Seeps	160	62.5%	600	47.3%
Consumption of Petroleum	84	32.8%	480	37.9%
Transportation of Petroleum	9.1	3.6%	150	11.8%
Extraction of Petroleum	3	1.2%	38	3.0%
Total	253.1		1230	

Source: National Academies Oceans Studies Board Report "Oil in the Seas III" Copyright 2002

Drilling for and production of Oil and Natural Gas are responsible for only 1% of ocean pollution in North America



Over the years, and at the direction of the legislature, Louisiana regulatory agencies responsible for oil and natural gas exploration and production (notably the Department of Natural Resources, Office of Conservation, with assistance from the state's universities) have cooperated with, and assisted, the oil and natural gas sectors in the development of techniques and best practices and in implementation of new technologies in order to achieve the significant capability of co-existing safely. Much of the know-how developed here in Louisiana has been transferred around the world as offshore oil and natural gas exploration has proliferated globally.

State Oil Spill Prevention and Response Act of 1991

The Louisiana legislature passed the Louisiana Oil Spill Prevention and Response Act of 1991 (OSPRA), La. Rev. Stat. 30:2451 *et seq.*, in response to the state's exposure to a major oil spill. The legislature found that, "This exposure, coupled with the limited adequate highway access to the coast …for rapid transportation of oil spill equipment… creates great potential for a major oil spill and its consequences in a state which has 26% of the nation's commercial fisheries, has the nation's highest marine recreational fishery catches, leads the nation in fur production and the world in alligator production, and has more over-wintering waterfowl than any other state."
The Louisiana legislature declared its intent "…to support and complement the Oil Pollution Act of 1990 (33 USC 2701 *et seq.*) and other federal laws, specifically those provisions relating to the national

contingency plan for clean up of oil spills and discharges, including provisions relating to the responsibilities of state agencies designated as natural resources trustees."

One role for the national trustees "…is to restore natural resources held in public trust which have been injured by the release, or threat of release, of oil, thereby, compensating the public for the lost resources and/or services resulting from the incident…."

Protecting the Nation's Energy Corridor

With passage of OSPRA, the Louisiana legislature continued to accept accountability for its national environmental protection and energy production responsibilities by creating the Louisiana Oil Spill Coordinator's Office (LOSCO) within the Office of the Governor. LOSCO was made part of the Governor's Office so that it could serve as the single point of contact for all programs related to oil spills in Louisiana. LOSCO is funded by a two-cent per barrel tax on all oil transported to or from vessels at Louisiana marine terminals. Currently, the legislatively mandated cap on this fund is $7,000,000.

LOSCO's primary function is to ensure effective coordination and representation of the state's interests in all matters related to spill response and prevention. **LOSCO's principal goals are to: (1) minimize unauthorized discharges of oil; (2) provide for an effective spill response; (3) compensate the public for damages to the state's natural resources; and (4) assist the public through education, service, and public outreach.**

Minimize Unauthorized Discharges

Louisiana's natural resources are susceptible to oil spill injury from a variety of sources. The primary objective of LOSCO's Prevention Program is to prevent the occurrence of unauthorized discharges of oil that impact Louisiana's resources. In the past several years, a large component of LOSCO's Prevention Program has focused on identifying potential oil spill locations and assessing the risks associated with these sites. To directly enhance prevention and eliminate the threat of unauthorized discharges, LOSCO has also initiated the Abandoned Barge and Abandoned Facilities Programs.

An inventory of the abandoned vessels/barges in the state's coastal waters was finalized in 1996 and identified approximately 800 abandoned vessels/barges of which roughly 200 were characterized as posing a potential pollution problem. Several barges have been removed through a cooperative federal/state partnership and many owners have removed vessels on a voluntary basis.

A total of, approximately, 25,000 abandoned facilities, pits, sumps, or reservoirs in the Louisiana coastal area have been inventoried and evaluated. The majority of the abandoned sites consisted of wells (60%), facilities (15%), and tank batteries (8%). The remaining sites were classified as manifold headers, metering stations, docks, rigs, and pits. LOSCO established a partnership with the Louisiana Department of Natural Resources/Office of Conservation to plug abandoned wells that pose a high risk for unauthorized discharge of oil, and eliminate the threat of a potential discharge from these sites. This joint venture, funded by industry, has resulted in the plugging and abandonment of numerous wells to date.

Spill Response

LOSCO coordinates the state agencies that are involved in cleanups. A LOSCO staff member is on call 24-hours a day as the State On-Scene Coordinator (SOSC) should the need arise. The response program has one goal – to insure that the state is ready to respond quickly and efficiently to any oil spill emergency and makes every effort to minimize adverse impacts from oil spills**.** LOSCO and its partners in state

government operate under a State Contingency Plan that describes how Louisiana agencies will respond during oil spills. LOSCO and the oil sector operators regularly participate in oil spill drills.
LOSCO has compiled an Environmental Baseline Inventory as the basis for the State Oil Spill Contingency Plan. The statewide inventory incorporates data such as protected areas, sensitive environments, transportation systems, potential oil spill locations, ocean currents, historical hurricane tracks, remedial action facilities, spill locations, and many other features needed for oil spill response and contingency planning.

Public Compensation

When oil spills injure natural resources such as waterways, vegetation, or wildlife, LOSCO and its Trustee partners seek compensation for the public from the responsible party. To guide their efforts they use a process called a Natural Resource Damage Assessment (NRDA).

To assist the natural resource trustees in carrying out their NRDA responsibilities for discharges or substantial threats of discharges of oil, Louisiana trustees have developed a statewide Louisiana Regional Restoration Planning Program (RRP). The goals of this statewide program are to: (1) expedite and reduce the cost of the NRDA process; (2) provide for consistency and predictability; and (3) increase restoration of lost natural resources and services. Attainment of these goals serves to make the NRDA process, as a whole, more efficient in Louisiana.

Research

Cutting edge oil spill research helps to protect Louisiana's uplands, coast, and every habitat in between. Since 1993, the Louisiana Applied and Educational Oil Spill Research and Development Program (OSRADP), LOSCO's research office located at Louisiana State University, has funded 119 subcontracts/letter agreements in support of 85 projects – 34 were funded for two years. These projects have examined response techniques, created new teaching tools, and developed more comprehensive data about spill risks.

Through these accomplishments of LOSCO and its state partners, the Department of Natural Resources, Office of Conservation, and the state's universities, it is possible to understand why the state of Louisiana leads the world in building sound and constructive working relationships with the oil and natural gas exploration, production, transportation, refining and processing sectors, for the ultimate economic benefit of America's consumers—and has been instrumental in transferring this "best practices" safety, and environmentally responsible knowledge, know how, and technology around the globe.

NOTE: The Department of Natural Resources wishes to thank Dr. Karolien Debusschere, Deputy Coordinator of the Louisiana Oil Spill Coordinator's Office, for her critique of, and contributions to, this article. For a much more expansive insight into the programs, services, activities, responsibilities, and capabilities of LOSCO please visit their web site at www.losco.state.la.us.